FACTS FOR THE MILLIONS

E. CHENERY M. D.

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STATE BOARD OF HEALTH
APR 29 1889
OF MASSACHUSETTS.

ALCOHOL INSIDE OUT

— FROM —

BOTTOM PRINCIPLES:

FACTS FOR THE MILLIONS.

By ELISHA CHENERY, M.D.,
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Man by nature is competently organized for truth and truth in general is not beyond his reach.—ARISTOTLE.

We are bound to have a clear reason for using that out of which so much evil grows.—JAMES EDWARDS, M.D.

OF THE STATE BOARD of HEALTH OF MASSACHUSETTS.

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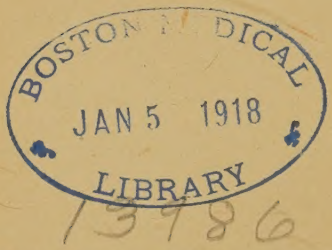

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TO

MY MOTHER

ON MARCH 20, 1889,

IT BEING HER NINETY-FIFTH

BIRTH DAY, IS THIS HUMBLE EN-

DEAVOR DEDICATED,—TO HER WHOSE

ACTIVITIES NEVER CEASE, WHOSE RELIGIOUS

ZEAL IS STILL A FLAME, WHOSE COMFORT AND

SUPPORT IN YEARS EXTREME, IS NOT THE BROKEN

REED WHICH BACCHUS LENDS, BUT JESSE'S SON'S SURE

ROD AND STAFF.

PREFACE.

THE question of questions before civilization, to-day, is

——— the frantic juice
Which Bacchus pours.

Approach it which way we will the subject is appalling: As an industry, it employs untold millions of money and tens of thousands of busy heads and hands; concerning society, it ramifies in all directions, obstructs the wheels of progress, breeds ignorance and poverty, burdens community with crime and costs, and is the loaded car on the ship of state gravitaing to the downward side; referring to the individual, it begets anarchy in all his members, injures mind and morals, and strangely perverts the physical, mental, moral condition of the generations springing from him; and not only this, it projects its influence into the other life and bars the gate of heaven against the indulgent, self-corrupted, drunken man.

Such a subject not only warrants, but infinitely demands consideration.

What here follows is confined to its relation to the individual, particularly to the effects of alcohol on the body, as being the corner-stone for all the rest; and my aim has been to turn the inner, deep facts out to the comprehension of every interested inquirer, by a perpetual application of such fundamental principles as all can easily understand.

In the first place, I have considered what and whence alcohol is; I have then traced it into and through the organism, noting step by step its physiological action and the harm it does; lastly, I have grouped such other material as remained under alcohol as a poison, as a food, and as a medicine, drawing

my facts and illustrations almost exclusively from the medical profession—from its teachers and its practitioners—so, like Minerva from the head of Jupiter, this work may be said to have sprung full-armed from the medical mind.

Through all I have endeavored to express myself in as easy terms as I well could, and yet I have been particular to quote my authorities in their own words, and this for two reasons: that where they alone were cognizant of the facts they state they might be responsible for what they say; and that where both of us had the knowledge we might speak together.

There is one thing that deserves our protest—the habit of conceding the benefit of doubts to the side of alcohol, whereas it is the glory of justice to lean to mercy, which, in this case, would give the doubt to injured humanity.

Moreover, alcohol has been too exacting in demanding positive proof against itself, and has rejected all circumstantial evidence, even of the most weighty kind.

These pages I am sure, will disclose two agreeable facts which will surprise many: First. The great number of medical men who are now breaking away from the errors and superstitions of the past, and Ulysses like, are courageously applying the heaven bestowed moly of truth to break the spell of this degrading enchanter at whose Circean touch

——— human forms divine
Head, face, and members bristle into swine.

Second. The length and strength of the chain of facts that science to-day puts into the hands of the friends of humanity with which to bind, hand and foot, the arch enemy of our race.

65 CHANDLER STREET, BOSTON,
March 20, 1889.

GENERAL OUTLINE OF THE SUBJECT.

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GENERAL OUTLINE.

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Wisdom Suggesting to the Wise.

NATHAN ALLEN, M.D., LL.D.,

Before the Massachusetts Medical Society, 1874:

There is no one subject agitating the public mind at this present day so important as temperance. Aside from its economical, political, and moral bearings it sustains a most vital relation to medicine.

Before this reform can be carried on very successfully, the exact relations of alcohol to health and disease must be better understood and positively settled.

How important then, that the members of the profession, who are the proper expounders of the sciences, should become safe teachers and guides in settling these grave questions!

TWO THOUSAND PHYSICIANS OF GREAT BRITAIN:

Total and universal abstinence from all alcoholic liquors and intoxicating beverages of all sorts, would greatly contribute to the health, the prosperity, the morality, and the happiness of the human race.

BOSTON MEDICAL
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ALCOHOL INSIDE OUT.

PART I.

Alcohol, What and Whence is It?

Its Parentage and Family Relations.

THE study of alcohol, like a biography, begins with the parentage and family relations of its subject. All about us in nature are substances having for their chief components the two chemical simples, hydrogen and carbon, and called *hydrocarbons*. Of the hydrocarbons, a number resemble in their properties that peculiar air or gas which bubbles up through marshy ground, arising from vegetable decomposition taking place under pressure beneath. These allied substances consist wholly of hydrogen and carbon, and form the *marsh-gas series* mentioned in the table below.

Table I.

Name.	Composition	Boiling-point.
Methyl hydride or radical	CH_4	Is a gas.
Ethyl "	C_2H_6	"
Propyl "	C_3H_8	—22°
Butyl "	C_4H_{10}	32°
Amyl "	C_5H_{12}	86°
Hexyl "	C_6H_{14}	140°
Etc.	Etc.	Etc.

Examination of this table shows that each succeeding hydride takes an added atom of carbon and two atoms of hydrogen, by which it grows heavier, and the boiling-point rises regularly by the space of 54° F.

Now, these hydrides are the patriarchs of the alcohols, and transmit their peculiar characteristics, or family traits, among which these (weight and degree of boiling) are two, to their latest generations.

The alcohols are their first offspring. They are given below, so far as it is in the interest of this writing to mention them. Their vapor-density is another trait derived from their parents. But the figures of their boiling-point, taken from Prof. J. P. Cooke's "Chemical Philosophy," are slightly higher than those commonly employed.

TABLE II.

Name of the Alcohol.	Weight, Water being 1000.	Boiling-point.	Vapor-density, Hydgn. being 1.
Methyl alcohol	——	151.7°	16
Ethyl "	796	173.1°	33
Propyl "	——	204.8°	——
Butyl "	803	228.2°	37
Amyl "	811	269.6°	44

Both the foregoing tables speak for themselves, and need no explanation. The traits which they bring out, however, must never be forgotten; they are vital to all intelligent investigation of the rôle of alcohol in the human body. Hence, a disregard of them has led many an honest inquirer to wander in bewildering mazes and reach strange conclusions.

The birth of an alcohol springs from the union of a hydride with an atom of oxygen, as shown below. The union of an alcohol with a further atom of oxygen produces an aqueous aldehyde, the new atom of oxygen combining with two of the atoms of the hydrogen, making a molecule of water, the remainder being the aldehyde, from which the water may be

separated. But this young aldehyde has a strong taking for marriage, and is soon bound up with another atom of oxygen. In this way arise the vinegars or fatty acids.

This, then, is the regular lineal descent in the process of the oxidation of an hydride: An hydride begets an alcohol; an alcohol begets an aldehyde with a particle of water, and an aldehyde begets a vinegar, below which there are no regular oxidations, only decompositions, putrefactions.

To show these changes directly before the eye, look at the following table of the alcohol genealogy:

TABLE III.

Hydrides.	Alcohols.	Aldehydes and Water.	Vinegars.
Methyl, CH_4	CH_4O	CH_2O+H_2O	CH_2O_2
Ethyl, C_2H_6	C_2H_6O	$C_2H_4O+H_2O$	$C_2H_4O_2$
Propyl, C_3H_8	C_3H_8O	$C_3H_6O+H_2O$	$C_3H_6O_2$
Butyl, C_4H_{10}	$C_4H_{10}O$	$C_4H_8O+H_2O$	$C_4H_8O_2$
Amyl, C_5H_{12}	$C_5H_{12}O$	$C_5H_{10}O+H_2O$	$C_5H_{10}O_2$
Hexyl, C_6H_{14}	$C_6H_{14}O$	$C_6H_{12}O+H_2O$	$C_6H_{12}O_2$
Etc.	Etc.	Etc.	Etc.

The order and regularity of this pedigree is certain. An ethyl hydride, or radical, for instance, in the course of its oxidation will inevitably beget: 1, an ethylic alcohol; 2, an ethylic aldehyde, and 3, an ethylic vinegar, or acetic acid. All of these will exhibit the ancestral traits. And what is true of the ethylic is also true of all the other radicals, down through a much longer list than is here presented.

To be sure, there are other marriages, but they are with other parties outside of this "blood-line;" with them we have nothing to do.

If, however, marriages below the vinegars be attempted, there is at once a family row, so to speak, and the family line is broken. An eminent Frenchman, Duplais, describes the scene: "The product becomes turbid, disengages ammonia, and deposits

an earthy sediment. The rest of the liquid is nothing more than water, whose fetid and repulsive odor infests all parts of the place where this fermentation is developed."

Foucroy, a great chemist, ("The Philosophy of Chemistry") speaks of the event in milder terms. He says: "Though all the circumstances of putrefaction are not yet described or even known, we have discovered that they are confined to the conversion of complex substances into substances less compound; that nature restores to new combinations the materials which she had lent, as it were, to vegetables and animals; and that she thus accomplishes the perpetual circle of compositions and decompositions, which attests her power, and demonstrates her fecundity in the course of her operations."

I have been thus particular with this pedigree that I might impress any reader who does not already know the fact with the exactness and definiteness of chemical processes. Like the threads of a warp, chemical laws run through to the end of the web, whatever the woof may be. Whether we be wise to profit by them, or ignorant and turn them against us, they are inexorable. In food or poison, inside or out of the body, they are the same, and work for good or evil as we may elect.

With the alcohols below the fifth of the series we have no present concern, since they will not increase our knowledge in the things we wish to know.

The second is the common form. But before we begin the direct study of it, a few things need to be said about the other four forms, for, in one shape or another, they often occur in the common alcohol; besides, a knowledge of their properties and actions will throw much light on some of the darker ways of the ethylic form.

I. METHYLIC ALCOHOL.

Referring to Table III, it is seen that this alcohol stands first in the series, being composed of one atom of carbon, four atoms of hydrogen, and one of oxygen. Its boiling-point is 151° F., or 61° less than water, by which we understand it very readily passes into vapor. It is the lightest of the several forms. The eminent French chemist, M. Berthelot, produced this alcohol in his laboratory by causing water and olefiant gas to combine by means of chlorine. But the usual mode of its production is by a process known as the *destructive distillation* of wood; that is, wood is caused to burn in a chamber from which the air is excluded. Hence its name *pyroxylic* alcohol, wood spirit, or wood naphtha.

In most respects this alcohol resembles the common form, except it is lighter, more volatile, and is particularly characterized by a disagreeable, smoky odor and bad taste. However, this bad odor and taste may be removed from it, but at such a cost as to make it impracticable for ordinary use.

When existing in common alcohol, in as low a proportion as one part in three hundred, its presence can be detected by means of permanganate of potassa.

Like common alcohol, it mixes with water in all proportions, and is a remarkable solvent of all such substances as common alcohol dissolves. It burns with little smoke, and its heating power is greater than that of the common form, for which it may be economically substituted.

When pure it acts much like ethylic alcohol, only it is less harmful, and being more volatile its effects are more speedy and more transient; a drunk on it is sooner over.

Dr. B. W. Richardson, of London, from whom I

have a letter, elicited a number of facts connected with its action by experimenting on the lower animals.

Methylic alcohol formerly had some place in medicine, and was prescribed by a few for consumption, catarrhs, dropsies, diarrheas, dysentery, etc., but rarely with any good results. Its impurities have been deemed by some to be its most useful part. Being of little importance, it has been transferred from the front to the back part of the "Dispensatory," where, like the iota dropped down under certain Greek words, it serves a bit of history, showing the position it once held.

The remarkable solvent properties of this substance rendering it desirable for the arts, while its bad taste and disagreeable odor repelling the uninitiated from it as a drink, led England to introduce it for the double purpose of business and temperance. Hence, in the year 1855, when the tax on common alcohol being high, and some industries suffering on this account, Parliament passed an act allowing the common form duty free, provided it were first mixed with one-ninth of its bulk of this spirit, the mixture to be known under the name of *methylated spirit.*

Now, this mixture answered well for business purposes, and was soon in extensive use. Its services in promoting sobriety, however, were not so apparent; for, while it prevented the uninitiated from beginning and kept most who had begun from going on, there was a sufficient number of old topers to drink it to drunkenness, and so bring the well-meaning scheme into disrepute. The act, so well-meaning and doing good, was ineffectual against the confirmed drink-habit, against which no odors or tastes are a bar. With such the most repulsive things may not only become a luxury, but a positive delight, provided the alcohol or its equivalent of some kind is there. The

following instances may serve to illustrate this point:

Under the reign of the original "Morrill law," the sale of liquor being prohibited, I knew an old drinker who procured and drank daily a pint of an atrocious cathartic compound, the cathartic not affecting him as it did others. He paid twenty-five cents for the "bitters," and earned fifty cents per day for his labor, so that the law, by heading him off from other liquors, saved twenty-five cents to his needy family; otherwise, they would have received none. An apothecary stated to me that he had customers who would call for raw benzine and swallow it clear after it was passed to them. Others swallow turpentine, boot-blacking, hair-wash, and the like. Another man, who served in an anatomical museum, was in the way of drinking off the alcohol from the jars containing the morbid specimens preserved in it.

Not long since I was summoned to a woman in convulsions. She had drunk a half-pint of Sanford's ginger, prepared in French alcohol. This gone, she rummaged the house for more liquor, and found a large bottle of balm-of-Gilead buds soaking in strong alcohol. This alcohol she poured down her throat; it literally "gave her fits."

Since, then, as methylated spirit may take the place of the more potable form in the arts, and at the same time afford a very stubborn barrier against new and early tippling, what reason can be offered why a community should not protect itself by putting away the more inviting, tempting form and legalizing this compound in its stead?

But is alcohol in any way a real need to the manufacturer? This question I refer to a prominent manufacturing chemist, Dr. James R. Nichols, of Boston, who ought to know what he speaks. He says such has been the advancement in our day that "alcohol

is no longer a necessity in any of the arts or sciences. Its banishment would not deprive us of a single one of the indispensable agents which modern civilization demands."

II. PROPYLIC ALCOHOL.

This is third in the series, and consists of three atoms of carbon, eight of hydrogen, and one of oxygen. It is heavier than common alcohol, slower to evaporate, its boiling-point being carried up nearly to that of water. Propylic alcohol originates in the fermentation and distillation of common alcohol, and is with difficulty separated from it. Its constitution and family traits are well known. It answers no useful purpose, and is of no account except as a damaging agent in the other forms of liquors so far as it goes. On account of its weight, etc., its effects come in under the alcohols below.

III. BUTYLIC ALCOHOL.

Going down table III, the next in order is butylic alcohol. This is a still heavier alcohol, and requires sixteen degrees more of temperature to boil it than to boil water. It originates in common fermentation, particularly of beet-root, like the last, and is separated by continuing the heat of distillation after the lighter alcohols have passed into vapor. Its vapor weighs more than one and a half times as much as the vapor of common alcohol. It irritates and benumbs any animal tissue to which it is applied, and that for some time. Men and animals intoxicated by it lose temperature and begin to tremble, as they do not readily do when drunk with the lighter forms. The tremors once excited, continue several hours longer than when produced by common spirits. On beginning to recover, the tremors but slowly decline, requiring a long time for their total

disappearance. One drink of this liquor may induce the peculiar complex phenomena known as delirium tremens. We stated that the last form was bad in any liquor; this is worse. Its effects approach those of the still worse form next to be considered, and are classed with them. Thus we see with every increase of carbon in the radical, the alcohol derived from it grows worse, increasing also in weight and in insolubility.

IV. AMYLIC ALCOHOL.

This is the fifth in the series and the last we need to consider. It has the same amount of oxygen as all the others, but rises to five atoms of carbon and twelve of hydrogen. It is a still heavier liquid than any before it and its boiling-point is 270°, or 58° above the boiling-point of water. It is a clear liquid, having a disagreeable odor and an acrid burning taste. Having an oily nature, it has received the name of *fusel oil*, by which it is commonly known. This liquor is unfit for any stomach. It is mostly used for illumination, and, in connection with bichromate of potash and sulphuric acid, in the manufacture of valerianic acid, which is the basis of various modern preparations of valerian. Little need is there, then, of growing valerian-root, since the chemist can more conveniently produce its properties in the laboratory.

Amylic alcohol, like the last two alcohols, is always present in considerable amount in all newly produced spirits, especially in spirits from potatoes and rye. Since it requires 98° more of heat to change it to vapor than common alcohol, there is no need that much of it should be carried over in ordinary fractional distillation of the common form. Careful redistillations will get rid of most of what went over at first. If, however, the process of distillation goes on

after the lighter form is carried over, the temperature rises and converts the heavier forms, one after the other, into vapor and drives them forward for condensation.

The presence of any of these heavier alcohols, especially the last, in any liquor, in any considerable degree, depends partly, as we see, upon the substance fermented, partly upon the care taken in the distillation, but chiefly in a lack of proper efforts to get rid of them after they have been formed. It is, however, safe to say that some or all of these heavier alcohols, particularly this form, are frequently fraudulently introduced into the vile compounds sold as drinking liquors in all lands. Large quantities of this spirit, according to Dr. B. W. Richardson, are imported into Great Britain presumably for adulterating wine and spirits. The detection of fusel oil in another liquor, however, is the simplest imaginable, being based upon its abundant carbon, which does not wholly consume in its blaze. Hence, if a plate or glass be held for but a moment over the flame, the unburnt carbon will deposit on it as a soot, which will not be the case when any pure methylic or ethylic spirit is burnt. Both the propylic and butylic may be detected in the same way, only the stain will be less as the amount of their carbon is less. An alcohol, therefore, whose flame smokes a glass is not a pure ethylic alcohol, and is to be excluded as dangerous in proportion to this species of degredation. But there are few spirits which do not contain more or less of these heavier alcohols, while some preparations are deadly poisonous on account of them. A medical writer, writing in the interest of liquor, admits that "no person can drink distilled spirits a great while and live," where any considerable quantity of this form of contamination exists.

CONCERNING THE HEAVIER ALCOHOLS IN GENERAL.

In substantiation of my last remarks, I here introduce the testimony of a few able physicians.

Dr. Benjamin W. Richardson, who made several reports to the British Association for the Advancement of Science, states: "These heavier kinds of spirit are largely distributed for consumption, especially among the lower orders, and are possibly the cause of delirium tremens, as they are probably the cause of that continual coldness, lassitude, and depression which follow the well-known dinner with bad wine."

Another English physician, Dr. Sheppard, holds similar views, and is persuaded that very injurious effects are produced on drinkers in consequence of this species of adulteration.

The editor of the *London Lancet* states: "We have no evidence ourselves to show how far such adulteration may exist, but we know of a fact that it does exist, and we can accept that the effect of the fraudulent proceeding is to increase the already sufficiently injurious influences of common alcohol."

That the effects of the different alcohols are different according to the nature of the alcohol used, Dr. Richardson has clearly shown. Just in proportion as we ascend the scale and the amount of carbon increases and the alcohol grows less and less volatile, just in that proportion does it fall in with the conclusions to which the late Dr. Jacob Bigelow, of Boston, came in reference to poke-root, after a series of experiments with it as an emetic—"*it is slow getting under way, and it is slow leaving off.*" On the other hand, the lighter the alcohol and the more volatile it is, the sooner does it begin to act, and the sooner also does it cease its action. On this point chemistry and physiology go hand-in-hand.

This fact gives us a hint to the possible mode of

elimination of alcohol from the body—an interesting subject to be considered later on. It is found that the heavier the alcohol the more surely does it produce tremors, and the more persistent are they when they come. Propylic and butylic alcohols are worse than the ethylic in this respect, and the amylic is worse than they, requiring several days for recovery from its effects, and though common alcohol may produce intoxication readily, it is not likely to produce tremors and convusions until persisted in for a considerable time, while the heavier spirits are capable of producing them almost from the first.

Some recent experiments on frogs by M. Rabuteau, of Paris, throw light upon this subject. When one part of common alcohol is mixed with fifty parts of water the vapor of the mixture does not appear to hurt the frog. A solution of the same strength of the next heavier kills them in a few hours; the heavier still kills them in one hour; while the amylic destroys them at once. Indeed, one part of this last to five hundred of water poisons these animals when simply exposed to its vapor.

Rabuteau discovers so great difference in the action of the lighter and the heavier alcohols, that he distinguishes alcoholism into two varieties: *ethylism*, which is characterized by the laughing joviality of old Bacchus, and *amylism*, or *polyalcoholism*, having for its character heavy stupidity, due to the use of modern whisky.

Since, then, as all alcoholic liquors are, or are liable to be, contaminated with these heavier spirits to a greater or less extent, and by consequence are all the more poisonous, the cheaper liquors usually being the worst, it becomes a matter of the utmost importance, both to the physician, who thinks he must use liquors, and to the patient, that all such liquors as are thought

necessary for the sick should be obtained from some specially qualified chemist, who should know through what lines his liquors come, and be sure that they are only of the ethylic kind. But, if it were impossible always to obtain the purified ethylic form, it is certainly possible and practicable to detect and exclude the most harmful adulterations. By appointing and patronizing such an agent, one could be sure of obtaining an approximation, at least, to what he thinks he buys, and the profession could hold up its head instead of suffering the humiliation of supporting the common liquor-shops, so sharply characterized by Archbishop Percell as "the craters of hell."

Ethylic or Common Alcohol.

I. ITS PROPERTIES.

The term alcohol is of Arabic origin. In the East it is applied to an impalpable powder, particularly to a species of cosmetic. It means that the substance to which it is applied is of a finely divided and subtile nature; hence, its transfer was easy to the subtile and "invisible spirits of wine." Ordinarily, the word is used to denote a highly rectified spirit. More particularly it is applied to this form of chemical substance I have come to consider, of whatever strength and wherever found. In this last sense I shall hereafter use it, except where qualified by another word.

Ethylic alcohol, as Table III shows, is the second in the list, and consists of two atoms of carbon, six of hydrogen, and one of oxygen. It is simply the oxidation of the ethyl radical in the first degree, or hydrated oxide of ethyl. It and the methylic form are called the lighter alcohols.

Pure alcohol is clear, without color, has a strong, but not unpleasant, fruity odor, and a pungent, burn-

ing taste. Its specific gravity or weight is .796, being a little less than four-fifths the weight of water. It boils at 172°, or 40° sooner than water, while a cold 198° below the point where water freezes has not frozen it; it simply so condenses it as to give it an oily appearance. It burns readily with a pale-blue flame, which is scarcely perceptible in daylight, giving out a great amount of heat, and at once passes into carbonic acid and water, with not a vestige behind it, for the atmosphere has lent to its hydrogen and carbon just sufficient oxygen to consume it entirely, and that without smoke. If alcohol be forced through a red-hot porcelain tube, so arranged as to exclude all air, the alcohol is burnt all the same; that is, its atoms are divorced from each other and left to marry in a different way. Thus, a portion of the oxygen unites with a portion of the carbon and forms carbonic acid as in ordinary combustion; and the rest of the oxygen combines with a part of the hydrogen to form water, while the remaining carbon and remaining hydrogen unite, producing carburetted hydrogen. The above process is given in order to show how *difficult* it is to detach the several atoms of alcohol from one another that they may be free to combine into new compounds. This fact should be emphasized, since it will frequently meet us in our future inquiries, and is too little regarded by writers on the physiology of this agent.

Another most important fact in the chemistry of alcohol is its *great affinity for water*, with which it unites in all proportions. This affinity is seen in the following experiment: Let a quantity of alcohol measuring 53.937 parts be mixed with 49.836 parts of water; the whole will measure but one hundred parts, showing a shrinkage of 3.775 parts, or nearly 4 per cent.; at the same time there is a considerable elimination of heat.

We have seen that it boils 40° before water, yet it cannot be freed from water by fractional distillation, for it will always carry over with it at least 11 per cent. of the water. Thus, the strongest alcohol obtainable in this way is an 89 per cent. alcohol. To free it fully, quick-lime, or some other substance which has a very great affinity for water, has to be used. When wholly separated it cannot be so kept except by perfect sealing, for otherwise it will abstract water from the atmosphere and decrease in strength. Such alcohol is rarely made, and never for ordinary uses.

Standard alcohol of the United States has 15 per cent. water; that of Great Britain—the so-called *rectified spirit*—16 per cent. *Proof spirit* has 51 per cent. water, or just sufficient alcohol to explode gunpowder when mixed with it and set on fire. This was an old test. The modern test is a specific gravity of .920. Above or below this strength it is above or below proof.

Dilute alcohol has a specific gravity of .941, or 61 per cent. of water; that is, it is an alcohol of 39 per cent. strength.

The Tinctures.—Absolute alcohol enters into none of the preparations of pharmacy. Just a few of the tinctures have alcohol of the standard strength. Proof spirit is used in others; but the great proportion of them are prepared with dilute alcohol. Why alcohol is used at all is because: 1, it dissolves certain useful substances which water will not dissolve; 2, it refuses solution of certain inert or harmful substances which water alone would take up; and 3, its well-known antiferment qualities aid in the preservation of the preparation. Beyond these it is of little certain benefit; while its presence is often a positive hindrance to the usefulness of the medicine dissolved in it. So far as regular medical practice is concerned, the tinctures are much less frequently

employed to-day than they used to be, their place being taken by fluid extracts, solutions in glycerin, triturates, variously prepared pills, and other eligible forms. Upon the whole, there is at present a great decrease in the size of the dose, partly because of the greater concentration of active principles, and partly because improvement in knowledge enables to get along with less. Moreover, water, light, more air, and other hygienic means have come largely to take the place of the old-fashioned drugging. There is still room for improvement in this line, and the work should go on till our trusted apothecary can safely raise his business above the dead-level of the common groggery, where too many of them now practically stand.

II. THE SOURCES OF ALCOHOL.

Alcohol does not belong to original creation. It had no place in an unsinning Eden when

> Great Spring
> Greened all the year; and fruits and blossoms blush'd
> In social sweetness on the self-same bough.

It comes from *de*generation. It is a chemical product of parasitic decay, whose face is backward towards "Chaos and Old Night." It devours our delicious sweets and heaps upon us more sin and sorrow than all other causes combined. It destroys our food and then makes war upon us. In the language of Brillat-Savarin, it "is the king of liquids; it becomes in our hands a formidable weapon; for the nations of the New World have been almost as much overcome and destroyed by brandy as by firearms." By the degrading transformation, our enjoyable sweets become our bitterest foes, whose relentless ravages the history of the ages shows.

Only sugar can produce alcohol. But a thousand other things may be made into it by first being changed into sugar. Thus, fruits, fleshy roots, potatoes, milk, grains of all kinds, woody fibre, and even the shirt we wear—bosom and body—are capable of such a transformation. A hundred pounds of old rags, according to Braconnet, will yield one hundred and fifteen parts of white sugar. An enthusiastic chemist boasted that "a block of wood may become a loaf of sugar in the hands of the modern chemist." The truth is, that anything that, by chemical process, can be converted into sugar, may afterwards be turned into alcohol, but it has to be sugar first.

Honey, grapes, and other saccharine fruits were formerly the chief source of alcohol in Europe. In later years, beet-root, rice, potatoes, carrots, turnips, artichokes, daffodil-roots, corn-stalks, sorghum, molasses, the various saccharine fruits, and the grains are laid under contribution for it. Most of the alcohol produced in America comes from Indian corn, potatoes, and the various grains. In some localities it is derived chiefly from the orchards; in others, especially in California, grapes are doing their old-time duty. But, whatever be the possible source of alcohol, it remains true, that in all countries nearly the entire amount is produced from what is or may be food. Hence, the manufacture of any considerable alcohol in any community is an evil, since every distillery is multiplied energy for the destruction of the peoples' bread, thereby oppressing the poor by augmenting the difficulty of subsistence, increasing sickness and death, and rendering wide-spread famine possible.

There seems something strangely out of character when medical men everywhere, without fee or reward, are bending every energy to prevent the destructive

ferment-germs in surgery and disease, and so save life and improve health and longevity, that another class of men, for mere money gain, should be as active in sowing these agencies broadcast into the peoples' bread for the destruction of their daily food—their first necessity—and so undoing all that the best efforts can do, ravelling the web behind as fast as woven in front. Let this business once stop and this waste cease, how speedily would its spacious structures become storehouses of bread, and every land be as the land of Egypt in the years of plenty! No more then would any people live as so many now do, "from hand to mouth," nor would gaunt famine stare us in the face the moment fruitful showers cease to fall, or caterpillars or grasshoppers appear for a season. Who founds his utopia on the universal abundant supply of food, builds no imaginary state.

III.—HOW IS ALCOHOL PRODUCED?

1. *Vinous Fermentation.*—*Wine.*—Legend refers the discovery of wine to Jemsheed, an ancient Persian king. Being very fond of grapes, he undertook to preserve some of the delicious fruit for such seasons as it could not be gathered from the vines. To this end, he had a large tank filled with grapes and placed in a vault. In due time the order for them was replied to by the answer that there were no grapes in the tank—only a dark, pleasant-tasting liquid. This pleasant taste was considered as proof that it was poisonous, and some of it was put into bottles and labelled accordingly. A servant-maid, subject to terrific headaches, and in a fit wishing herself dead, saw the "poison," and drank, to end her headache and miserable life together. The effect was not to kill her, but to mitigate her suffering. Again and again, as the headache recurred, she resorted to

her new-found remedy till all was gone. The king, missing the "poison," made inquiry, and the maid confessed, whereupon the bottles were again filled, and the king drank for his own ills, and so popularized the use of wine, as the use of tobacco was since popularized by an official in France.

Turning from legend, Scripture carries us back to the second father of his race, who, coming down from Mount Ararat, planted a vineyard, made wine, and got drunk.

The *vine* is indigenous to India and Asia Minor, from which latter place it is supposed to have been carried into Africa and Europe; and the Romans are credited with its introduction into England. Egyptian hieroglyphics speak of wine.

Vinous fermentation is that peculiar spontaneous fermentation which takes place, under suitable conditions, in apple and grape juice, and in the juice of all other saccharine fruits and berries, after the fruit has been bruised and its sweet juice mixed with the nitrogenous compounds of the cell-walls, and the mixture allowed to stand awhile in contact with the air. There appears to be an exception to this in the legend just quoted, and I have heard that there is an exception to this in the case of blueberries, barrelled and set in a cellar. Of this I am not sure. We never attempt to make wine but by crushing the fruit.

This mixture of sugar and albumen is *must*. After a few days' exposure to the air, in a moderate temperature, it becomes turbid; a motion sets up, and bubbles rise to the top and escape, while the sugar is being decomposed and the albumen destroyed. This remarkable change is produced by the agency of certain minute germs or cells, called *mucedines*, which inhabit the air. They descend into the exposed liquid, destroy its albumen, and decompose the sugar,

splitting it into two portions—carbonic acid 49 parts, and alcohol 51 parts. The carbonic acid rises in the form of bubbles and escapes, while the alcohol, remaining in the liquor, makes the *wine*—wine on the lees, or destroyed albumen and the carcasses of the mucedines which have died and settled to the bottom.

If the wine subsequently sours, becomes filmy, oily, or bitter, or takes on any other alteration, it is in consequence of the action of similar microscopic agencies, pointed out by M. Ferdinand Papillon, and fully described by that great French scientist, M. Pasteur.

As this subject of fermentation is of so great importance, and is to meet us at so many turns in our studies, it is proper to dwell more at length upon it here.

Vinous fermentation is a type of all other fermentations, since they, like it, take place by virtue of the presence of a living agency, in the form of microscopic germs. The yeast germs, being much larger than the wine ferment, can be observed by the naked eye if a glass containing it in a thin, fermenting mixture be set in the window in the sun. These little bodies will then be seen slowly rising to the surface, where they give up a particle of carbonic acid gas, and absorb oxygen from the air, and, becoming heavier than the liquid, descend to the bottom, giving out the oxygen and getting another freight of carbonic acid in the depths of the liquid; with this they ascend to the top, as before. Thus do they incessantly ply between the fluid mixture and the air above. This is not only a type of fermentation in general, but also a striking illustration of the work done in the animal economy by the action of the little cells—the blood globules—as they ply between the air in the lungs and the interior of the tissues

through the circulation of the blood. They take in oxygen and give out carbonic acid in the same way, being impelled forward by the heart. Both MM. Blondeau and Pasteur have called attention to this wonderful and intimate physiological relation. Other physiologists have noted the same.

Acetic fermentation, or the change of wine and cider into aldehyde, and thence to vinegar, or acetic acid, is carried on in the same manner, except that in this process the cells aggregate into a film—*the mother of vinegar*—on the top of the fluid, where they abstract oxygen from the air and impart it to the cider beneath. If, by any means, this film be removed or pushed beneath the surface, the fermentation will be hindered. The deeper the liquid and the narrower the surface exposed to the air, the slower is the change. On the contrary, the broader the surface and the shallower the fermenting liquid, the more rapidly does the fermentation take place. On this fact is based the new or German method of making vinegar by causing the cider to trickle slowly over shavings in the presence of a current of air. Thus is done in thirty-six hours what months are required to effect in the old way.

Putrefaction is but another form of fermentation. Here the *bacterium termo*—a little carrion germ—is the active agency.

Since, then, as all fermentations are carried on by minute, living agencies, it has been, of late years, a great study how to destroy these agencies and prevent the changes they produce. The result has been marvellous, almost revolutionizing surgery and medicine, and bringing in one of the greatest and best industries of modern times—the canning business. On the results of these studies are also grounded our great modern sanitary systems.

Many agents will kill, or, what is practically equivalent, sterilize these germs—some one germ and some another. Heat is found to kill the ferment germs in the substance to be canned, and air-tight sealing sufficient defence against the beleaguring forces in the outside atmosphere.

Sulphurous acid, which is a gas, is also very destructive to minute organisms. After apple juice has fermented into apple wine, commonly called cider, four ounces of bisulphite of lime to a barrel of the cider will stop its further change into vinegar; the acid of the cider acting on the bisulphite causes elimination of a portion of the contained sulphurous acid, which, diffusing in the liquor, keeps it from growing hard.

It is an old practice to burn sulphur in the empty space of a barrel nearly filled with wine till the fumes of the sulphur mingle with the wine, when it is bunged. The Moselle wines are so preserved, or else they would require the addition of more alcohol to keep them. Of course, such wines are weak, and flat to the taste.

Great concentration of fruit-juice, by boiling it into a syrup, secures it against the action of the ferments, and, when wanted for use, it is only necessary to extend it by adding water. *Pez mez* is a semi-solid preserve, prepared by the Turks in this manner, and is extensively used among them for butter and molasses and as an article of trade. Let parents try the following, and see how their children like it: Select good, sound fruit in its season—cherries, plums, peaches—just ripe and not overripe; wash the outside and dry; cut and remove the stones, and drain on a cheese-cloth; put into jars first two inches of very dry sugar, then a layer of fruit, followed by an inch of sugar, and then fruit; and so on up to the top, the last being sugar,

putting on a cloth and a weight for a week or so, filling with sugar as the mass settles. The sugar will absorb the moisture and keep from change. The result is charming.

Having at our command so varied, easy and effectual means for preserving our delicious fruits and fruit-juices, why do we degrade them into alcohol in order to preserve them? By so doing we only save the name, while the chemical composition of the juice is altered, and what was albuminous and sugary, and so nourishing, has been destroyed and lost in the unnatural, fiery liquid which has taken its place. Why do we not rather load the family table with the luscious fruits and their juices, so cheaply procured and so easily preserved? And what excuse have we for presenting the Lord, at His table, a "blemished sacrifice," when it is so practical to offer the pure "blood of the grape?" And when was that curse recalled which was pronounced against him that puts the cup of the drunkard to his brother's lips? Has it been recalled for this special occasion? Too many have had their appetite for strong drink rekindled here.

Strength of Wines.—When the process of fermentation is completed, both the albumen and sugar have given place to alcohol. The liquid is now a *wine—wine on the lees.* If it happens that there was but little sugar in the must, there will be but little alcohol, and the wine will be *dry.* Such is the claret. If there was only a small amount of albumen in proportion to the sugar, the fermentation has to stop, with the disappearance of the albumen, and the excess of the sugar remaining gives a *sweet wine.* If both the albumen and sugar be in abundance, the fermentation will cease from the presence of the alcohol when the wine has reached about 15–17 per cent. strength; never over 20 per cent. Hence, it is not possible to ferment a

stronger wine than that. Therefore, all wines having a greater per cent. than 15–17 have had alcohol added from without, and are not natural wines. Should the amount of sugar be 30 or more per cent. of the *liquid*, the fermentation will not set in, the sugar preserving it—a circumstance made use of in such preparations as the syrups and preserves in sugar.

Most of the celebrated ancient wines seem to have been syrups or extracts, and consequently not intoxicating. The wines in greatest repute among the Greeks and Romans were highly charged with sugar, though a bottle exhumed from the Roman cemetery of Aliscamps, near Arles, one of the oldest towns in France, in 1877, and analyzed by the noted chemist, Berthelot, contained 4½ per cent. alcohol. It was, however, perfectly preserved, being hermetically sealed. The wines of Arcadia were so thick, by boiling or adulteration, as to dry up in the goatskins, requiring to be scraped off and to have water added. Such, probably, were the thick wines of Crete, Thasos, Chios, and Lesbos.

As natural wines cannot exceed 15–17 per cent. alcohol, so they may be as low as 2 or 3 per cent. On an average, natural grape wines have 10–14 per cent. According to Guijal, the highest possible for port wine is 12½ per cent. Dr. Gorman told a committee of the British Parliament that the highest for pure sherry was 12 per cent., and that the strength in the shops has been produced by spirit from other sources. Wines, therefore, as they naturally form, are too weak for preservation and transportation, and must be transformed into a fiery liquor, though still holding their former name.

The following list of the best known medicinal wines speaks for itself. From the figures we may approximately calculate their *added generosity:*

ANALYSIS OF SOME OF THE WINES IN RELATION TO THEIR ALCOHOL.

Name.	Chemists.	Strongest.	Mean.	Weakest.
Lisa,	Brande,		25.41	
Raisin,	"		25.12	
Sicily Madeira,	Dr. Jones,	21.10		19.90
Port,	Brande,	25.83	22.96	19.00
"	Dr. Christison,	20.49	18.68	16.80
"	Dr. Jones,	23.20		20.70
Madeira,	Brande,	24.42	22.27	19.24
Sherry,	"	19.81	19.17	18.25
"	Dr. Christison,	19.31	18.47	16.96
Teneriffe,	Brande,		19.79	
Lisbon,	Dr. Christison,		19.09	
Red Madeira,	Brande,		20.35	
Cape Madeira,	"		20.51	
Malaga,	"		17.26	
Claret,	"	17.13	15.10	1.291
Burgundy,	"		14.57	
Hock,	"	13.00	12.08	9.50
Champagne,	"	14.80	12.61	
Tokay,	"		9.88	

The California wines are nearly all largely fortified.

Dr. Bouchardat says that such alcoholic wines as are represented by Madeira and Marsala are always overcharged with alcohol. The British custom-house regulations allow the addition of 10 per cent. of brandy to wines which have been imported. By means of sulphur and other substances, which destroy the ferment, some few wines of inferior flavor are sent into the market having a less amount of alcohol than the above.

Wine made from the juice of apples, and known as *new cider*, has from 6–7 per cent. alcohol; wines from rhubarb and cherries, 7–9 per cent.; from strawberries and currants, 8–10; from raspberries, blackberries, peaches, etc., 9–10 per cent. Dr. S. Dana Hays, late State Assayer of Massachusetts, gives hard cider as high as 10½ per cent.

The kinds of grape wine are as countless as the varieties of grapes from which they are made. Thus, Hungary furnishes four hundred varieties, and France boasts of between one and two thousand. Of their number in Italy, even before the Christian era, Virgil wrote:

> Which, who would learn, as soon may tell the sands,
> Driven by the western winds on Libyan lands;
> Or number when the blustering Eurus roars,
> The billows beating on Ionian shores.

I have hitherto spoken only of genuine wines—wines naturally weak, and preserved in their weakness by some artificial means, or by the increase of their alcoholic strength from without. I have now to speak of their *adulterations and sophistications*.

It will surprise no one when I state that the extent of the manufacture of bad wines, and the sophistication of the better ones, is a marvel of our age. But we may always remember that whatever poison may be put into them, their supreme poison, with rare exceptions, is the alcohol itself. Indeed, it matters comparatively little with what vehicle the alcohol is mixed or taken: it may be fruit-juice, it may be an infusion of some herb, the soakings of an oaken cask, or chips of logwood; it may be this julep or another, or merely sweetened water with an old shoe thrown in to give it flavor—it is in effect the same if the alcohol is there. But one can hardly help feeling a kind of satisfaction when he knows that the port or sherry, as the case may be, which he has paid for dearly and is taking, is really port or sherry, and not something wholly different.

Let us see what prospects the market affords for our obtaining a pure genuine grape wine.

"I grow," said a French wine-maker, "400 pipes of wine on my estate, and I sell 10,000."

Out of 3001 samples of French wines examined in 1881, 1731 were found bad, and 991 of the rest only passable. But this relates to wines brought into France, while those which go out are not examined at all, presumably because they are so much worse.

The American consul in Paris calls the attention of this Government to the manner in which French wines are adulterated with other substances than alcohol. A long list even of poisonous substances here follows with which such wines are fabricated: Alum is largely used in Bordeaux wines to give astringency, while logwood has first place in Paris wines. Beet, fuchsin, and cochineal are the favorite colors for the South of France, and elderberries for Portugal and Spain. Arsenic, grenat, and various aniline salts rank high as coloring-matters for these fabrications. In the departments of Herault, Pyrenees, and Var lime is used to highten the color and reduce the lees, but by so doing chemical changes supervene, with the effect of a purgative, and even corrosive nature to the liquid.

Dr. C. Blarez sends to the Bordeaux Medical and Surgical Society that the conclusion he has reached after numerous experiments is that sulphofuchsin, which is used for this purpose, though hardly a decided poison in the quantities taken at a dose, does set up a good deal of gastric disturbance, especially if habitually employed, the symptoms being colic and diarrhea. He found this substance, "Bordeaux red" and safranine, would distinctly retard the peptonizing process.

Linden and Margot have lately been tried in France for selling spurious wines, as Mâcon, St. Julien, St. Emillon, etc., which examination showed were not wines at all—mere compositions. Several wine shopkeepers came to their defence, asserting that their wines were not worse than any other, on which the

judge remarked that it was not saying much for the articles they sold. One of them thought it was not much matter, as "people nowadays drank such muck." Another said the wine gave his children such gripes he poured it out into the gutter.

A reliable medical writer of this country states that, in the year 1866, the town of Oporto, in Portugal, shipped from its docks five times more wine, under the name of port wine, than it was possible to produce in the entire Douro Valley, where the port grape is cultivated; that in the same year London consumed twice as much port wine as was shipped from Oporto; that New York, at the same time, used and sold half as much as London. Thus, two cities only made way with *fifteen* times as much port wine as it was possible to produce from port grapes. If, now, we add to this the rest of the world where stuff called port wine is used, we have not *one chance in a hundred* of getting "port that is port."

Moreover, the authority of the "United States Dispensatory" is to the point, that port wine is sometimes made up of a small portion of red port wine, mixed with cider, juice of elderberries, and brandy, and colored and rendered astringent with logwood and alum.

Prof. Mulder tells us that a great deal of port is made in which there is not a drop of port juice, but that it consists of a concoction of gum-benzoin, gum-dragon, red saunders, tartar, tartaric, citric, and oxalic acids, logwood; to which there has recently been added to give it color and aroma, nitric acid and nitric ether.

What is true of port is equally true of sherry, Madeira, claret, Burgundy, champagne, and all other standard wines. We are informed that large quantities of claret are made simply by allowing water to

soak through wood shavings, and subsequently adding water, tartaric acid, and alcohol.

The two cities, Chicago and St. Louis, are said to use quite as much wine of California brand as is produced in that State; and yet every city, at home and abroad, advertises "California wines." So perfect are the sophistications, that a California grape-grower declares he cannot distinguish the fabrications from his own genuine productions.

A communication from California says that that State produced in 1886, $3,000,000 worth for exportation, and $5,400,000 for consumption in the United States; while from another source we learn that 75,000 gallons of aniline dye were shipped into that State with which to color wine.

Spain, a wine-growing country, for a long time till recently, imported, according to Mr. Vizetelly, British Wine Commissioner to the Vienna Exposition, 1,600,000 gallons of British spirits, which she now no longer does, having turned her importations from Prussia, where a cheaper article is obtained, largely impregnated with butylic and amylic forms from beets and potatoes. England is using this same pernicious spirit to fortify port wine in bond. It is not a whit better in Germany. For a number of years the grape crop has fallen off at Baden, yet their finest wines have increased instead of diminishing. The government taking it up, found that very large quantities of spirits have been slyly imported into Baden and there prepared, bottled and sold as fine German wines, an imported French "artist" having directed the manufacture. One leading house had purchased 300,000 marks worth of foreign spirit, and sold during the first half of 1880 more than 500,000 marks of fine wines, it being as easy to produce chemical hock as chemical clarets.

The truth really is, when one part of the globe gets

what is regarded a good article and selling at a good price, it becomes a thing, like new French styles in general, for every other part of the world to imitate, till the fashion has had its day and lost its charm. At this present writing, England is indulging in Greek and Hungarian wines as though they were all genuine. Says one who has been there: "There are no pure wines in all Italy to-day."

From what has now been said, without further multiplying authorities, *it is evident that a genuine wine is a rare thing in the market.* So that whatever argument may be offered in favor of a pure wine, it will hardly do here, since the chances are exceedingly small that such a wine could be had even on a physician's order. Practically, then, such arguments are worthless, and, to get around it, Duplais declares it to be his belief that the *factitious cordials are more healthy than many of the natural wines;* statements singularly at variance with the popular belief concerning counterfeit wines. But a crowning course to deception comes to us at this time, for, as if we were ignorant of the fact that a large per cent. of the stuff sold as wine never saw a grape, but is a product of the distiller or the brewer, we are urged by flaming advertisements to patronize a new product sold under the name "*malt-wine.*"

Other Constituents of Wine.—Of the several substances which existed in the grape juice before its fermentation, the most valuable, as the albumen and sugar, representing the nutritious qualities of the must, have been almost wholly destroyed. Others have remained unchanged and appear in the wine. Aside, then, from the alcohol and the ethers which have been developed in the process of fermentation, the chief constituents of wines are their acids, tannin, sugar (when that is not wholly destroyed), gum, extractives, etc., etc.

Now, it would be worth while to stop and consider these in detail were wines ever taken on account of them. But who ever thinks of giving or taking wine for its trace of sugar, even if it has any? for its œnanthic ether? its tannin? its acids? or its extractive matters? But if any such substances are wanted, they can be obtained more conveniently, cheaply, and definitely some other way. Not one nor all of these combined would be of the least account as a beverage were it not for the alcohol in connection with which they happen to be found. It is for this alone that wines are given and taken. Upon this is their strength rated and their chief good or evil turns. Aside from the alcohol, wines would be nearly worthless, not to say they are less so with it. Therefore, the wines must be ranked with alcohol and share in the judgment which is accorded to that, whatever that judgment may be.

Further Considerations.—But there are still other considerations which require notice before leaving this subject. It is to be distinctly borne in mind that *there are no genuine fruit wines which are not more or less tart on account of the acid of the fruit from which they are made.* Now, much wine is boasted of by its venders as "perfectly free from acidity." Let us see how this is brought about.

A common way by which the acidity of a genuine wine is removed, so as to hurry it up and make the new wine old without delay, is by the use of common plaster-of-Paris—sulphate of lime. When this substance is added to wine a double chemical decomposition occurs. In the first place, the natural tartrate of potassa, upon which the wine chiefly depends for its tartness, is broken up, and a portion of its acid unites with the lime and forms an insoluble tartrate of lime which settles to the bottom. In the second

place, the sulphur of the plaster combines with the potassa of the acid and forms the soluble but bitter and nauseous sulphate of potassa which remains in the liquor. Such wines have a bitterish and sickly taste, and, if the potash is not positively harmful to the body, it certainly can do it no good. But there is reason to believe that the potash is harmful, since kidney disease is so frequent in those who "tarry long at the wine;" for these organs are the ones by which this salt is removed. The only proper way to get rid of the acidity of grape wines is to *give them time to grow old*, allowing the acid chance to separate by spontaneous action. And this brings out a remarkable and fortunate circumstance connected with grape wine, which occurs in no other wine.

It seems that the sugar of the must, while it exists, serves to keep the grape acid in a state of solution; but after its destruction by fermentation, the liquid can no longer hold the acid, which settles on the sides of the cask, producing the argol or tartar from which all our tartaric acid and cream of tartar is made. As, by time, this acid is precipitated, so the wine grows less and less sour within certain limits. All other wines retaining their acidity are too sour and harsh for the stomach, being doubly harmful as compared with moderately old-grape wine—by their acid as well as by their alcohol.

But it is a fact not generally understood that wines soon cease improvement by age and begin to deteriorate, and may become as sour as they were at first by a new and more irritating acid. Hence, the claim for "old wines" is bar-room gush and humbug, and not the deductions of science. This subject has recently been fully sifted by the German chemist, Winkleman, who shows that very old wines are worse than the worst new ones, and positively injurious to health.

So far, however, as an occasional and limited amount of wine-acid is concerned, there is no reason to regard it more harmful than other equally strong vegetable acids, for, like them, it undergoes transformation in the body, yielding to the blood the alkaline carbonates which under certain circumstances serve to thin the blood and render the urine alkaline. The chief drawback of such wines, however, lies in the excess of their acids and the consequent oversaturation of the system by them. Again, there are *certain states or conditions of the body* which wholly forbid their use. Thus, they are contraindicated in the rheumatic and gouty, and in the uric acid diathesis, in nursing women, in inflammatory conditions of the stomach, and the like. According to Dr. F. Bache, the stronger wines, such as "sherry, port, Madeira, etc., even though taken in moderation, are *always injurious* as having a tendency to induce gout and apoplexy, and other diseases dependent on plethora." "In a state of health," he says of wine, it "is at least useless if not absolutely pernicious." Indeed, all wines when used freely give unmistakable evidence of evil effects. In the language of Dr. Bache, "they weaken the stomach, produce disease of the liver, and give rise to gout and dropsy, apoplexy, tremors, and not infrequently to mania." But it may be inferred that the alcohol, more than the acid, is the cause of these troubles. This will much more fully appear when we come to study the action of alcohol further on. Says an eminent English author, treating on the power of the different alcohols to induce gout: "My own opinion is that port, sherry, and other strong varieties of wines ordinarily drunk in this country, are most potent in their operation." Of the wines of Burgundy, Bordelais, and Côtes du Rhone, diluted or old, the testimony of

a Frenchman is that they "are just as frequently a cause of gravel and stones in which uric acid predominates as of gout, whilst the strong beers and alcoholized wines consumed in England and France favor in a greater degree the development of gout." Dr. Scudmore long ago pointed out the disastrous effects of champagne in producing gout.

The *tannin* of wines is an objection to their general use as a beverage, since it renders them harsh and rough, according to the quantity present. There are many stomachs which cannot bear the astringent wines. There is one fact, however, in their favor: the *tannin acts to retard the absorption of the alcohol.* Hence, the red wines, which contain the most tannin, are much less intoxicating than the white wines, which have little or no astringency, a fortunate fact for the system if not for the stomach.

Alcoholized or fermented communion bread deserves a moment here. The yeasty or leavening fermentation of dough is an alcoholic fermentation in which the saccharine or sweet principle of the sponge is split into carbonic acid and alcohol, the former being entangled in the meshes of the sponge, swells it up and makes it light, the latter escaping by evaporation and by the heat in baking. But all the alcohol is not removed, as is shown by Mr. Thomas Bolas, who, on examining many specimens of London bread, found on an average 0.314 per cent. still remaining. Now, every one who is familiar with bread-making knows that it is necessary to stop the fermentation of the sponge at the earliest possible point in order that the bread be sweet and tasty; otherwise, it will be dry and chippy and less nourishing. By this, as well as by vinous fermentation proper, we see that fermentation is a backward—a retrograde—metamorphosis, or, as Foucroy expresses it, a pulling down of higher

organizations to build up lower ones—a fact affording scientific grounds why fermented bread, or bread in which this retrograde metamorphosis had begun, was not suitable for the Passover service, since that sacrament was a celebration of life, not of death. Moreover, it was commanded, "Neither shall there be leaven seen with thee in all thy quarters" on this occasion.

If the rejection of fermented bread was in consequence of the ferment in it, surely the same must be accorded wine for the same reason, since the ferment in both cases is essentially the same. And to accept the wine and reject the bread places Him, who "came to fulfill the law and not to break it," as offering in one hand a blessing which was a curse in the other, and Himself as breaking the law against the presence of a ferment in the "quarter." To be consistent, we must reject the fermented wine with the fermented bread—a practice which will work no harm and will save from such a drunkenness, as we once saw in this city, on the part of a sexton well "set up" on the "blessed wine" which he took after the communion service was over.

2. *The Yeasty or Artificial Fermentation.*

The yeasty or artificial fermentation is here used in distinction from the vinous or spontaneous fermentation just considered. In this form the ferment cells are larger, and do not exist in the atmosphere to the same degree as the wine germ to sow themselves, but have to be introduced artificially. Like the wine-cell, the yeast-cell destroys albumen, consumes sugar, and produces alcohol. Just how the ferment germ brings about the change has been a matter of some question among chemists. It was the opinion of Prof. Liebig that fermentation took place by the "influence" of the ferment. Bergelius referred the effects to the

"contact" of the yeast. More recently, Dumas announced what is now the accepted doctrine, by regarding fermentation as a chemical change wrought by the "*vital force*" of the yeast plant. "If I consider," says he, "the alcoholic fermentation as a chemical fact capable of measurement and modification by chemical forces and agents, I do not the less recognize its direct and constant dependence upon the presence, the action, or, in a word, the life of the cellules of the yeast."

The distinction between the two kinds of fermentation is further seen in the fact that the peculiar acidity of must determines the action of the one peculiar vinous ferment. This is not the case with the wort. Hence, as M. Pasteur (*Études sur la Bière*) has shown, each fermentation has its own particular ferment, and any one of several may set up in the wort—lactic, butylic, etc.—and it is necessary to sow the one which will yield the desired ethylic alcohol, and not let the others have a chance. As we said of wines, so we say of beers after they have been formed: their deteriorations, as that of "turned," "ropy," or "putrid beer," depend on the action of particular microscopic germs.

There is another and a wider difference between the yeasty and the vinous fermentations: The sugar which the yeasty fermentation consumes does not naturally exist in the wort, but has to be made for it by first converting starch or some other substance, susceptible of the glucosic change, into sugar. Hence, artificial fermentation involves two processes: 1, a catalytic change of starch, or whatever else is used in its stead, into sugar; and 2, the fermentation of that sugar. This first step is not required in the fermentation of saccharine fruit juices, since the sweet principle of the must is already in a condition to be acted on by the wine cells.

The Diastasic Catalysis.—Now, this *glucosic* or *glycogenic transformation* of starchy substances into glucose (dextrose, maltose, grape, or starch-sugar) is just what takes place in the natural digestion of starchy food within the body of animals, for no starch is taken into the circulation until it has been changed into grape-sugar by certain fluids of the alimentary canal, mostly those of the duodenum, or portion of bowel next below the stomach. This change does, indeed, begin in the mouth by the action of the ptyaline, as can easily be demonstrated by chewing a handful of wheat for a few minutes and noting how sweet it becomes. This peculiar action of ptyaline on starchy substances has been discovered and applied in the production of spirituous drink by the Indians of South America, whose mode of procedure is as follows:

Having soaked a quantity of corn until it is soft and begins to sprout, the family and such of their friends and neighbors as may be in, each with his or her quantity of the corn, gather around a calabash placed in the centre of the room and spend the evening chewing corn and spitting the mouthfuls into the calabash. When this process is completed the mixture of chewed corn and spittle is diluted with warm water, yeast added, and set aside to ferment. The result is the highly-prized *maize-beer* or *chica;* and it is offered to guests as a very complimentary treat.

"Kawa" or "ava" is said to be prepared from macropiper or long-pepper in the same way by the islanders of the Pacific.

My friend, Chaplain Geo. A. Crawford, U. S. N., on a recent visit to the Samoans, where "kava" is in great repute, and, being about to attend a feast, managed to get out of the back door to see how they got up the delicious beverage. He found a group of

young women with good teeth and strong jaws—professionals in their way—munching the kava root from which it is made, and so passing the appetizer through its first stage.

Plant digestion of starch is similar to that which takes place in the animal body. The fixed nature of starch does not allow it to be taken up and appropriated to the nourishment of plants any more than to the nourishment of animals, starch being the form for storage, not for nourishment. It is, therefore, necessary that some change be wrought in the relation of its several constituent chemical atoms, in order that it may become assimilable. So, in the process of germination, a kind of organic substance is generated known as *diastase*, which acts on the starch of the seed, transforming it into glucose, just as ptyaline and the duodenal secretions transform it in animal digestion.

It has been said that a grain of corn cannot spring up "unless it die." The vital germ does not die, but by its life causes a death or change in the constitution of the body of the seed—the starchy part composing the bulk of the kernel—that the component elements may be taken up by the germ and builded into new forms of growth.

Precisely this "death" is what the manufacturer of alcohol from grain turns to account on a large scale. His first step is to soak and sprout the grain to develop the catalytic ferment—the diastase—and turn the starch into sugar, when by raising the heat suddenly to a destructive height—170° F. being sufficient to kill the diastase—the germinating process is "nipped in the bud." This process is called *malting*, the kernel of the grain becoming sweet. But the diastase is so powerful—converting 2000 to 20,000 times its own weight of starch into maltose, and being de-

veloped in excess by malting—it is possible to turn in with the malt much unmalted grain whose starch is readily converted by the diastase already developed, and thus the grain makes a short cut towards alcohol. Moreover, this fact of the wonderful power of diastase to convert starchy substances into sugar has been seized upon and the land flooded with various makes of malt for the stomach's sake, under the idea that it will do there precisely what it does on the outside. This matter, however, has just been carefully examined by Dr. Charles W. Townsend, of this city, and found to be a total failure and a fraud, since the natural hydrochloric acid of the stomach utterly destroys the power of this ferment which acts in alkaline mixtures. The claim for the high, nourishing quality of malt extract was also discounted by Dr. Townsend, who showed that it fell below that of ordinary food, thereby proving it to be a nourishment far fetched and dear bought.

Another process by which glucose and dextrine may be obtained is by the action of sulphuric acid on starch, and then getting rid of the free acid by chalk or marble-dust. But it matters little what be the source of the sugar or the mode by which it is produced, so long as the brewer can get out of it the three things he desires—alcohol, carbonic acid gas, and extract.

The next step is to dry, grind, and steep—marsh—the malt in water of about 180° for some time to get out the sugar and the albumen. This product is *wort* or *malt-tea*, and exactly corresponds to the must of grapes, except it is not certain to undergo vinous fermentation spontaneously, as must will. It is, therefore, necessary to sow in it a quantity of yeast-cells, which soon destroy the albumen and the sugar and produce the alcohol. *Beer* is the result.

Now, the capacity of any grain to produce alcohol determines its relative value for fermentation. This Duplais gives as follows:

100 kilogrammes[1]	of	wheat	yield	32	litres	of pure alcohol.
"	"	rye	"	28	"	" "
"	"	barley	"	25	"	" "
"	"	oats	"	22	"	" "
"	"	buckwheat	"	25	"	" "
"	"	Indian corn	"	25	"	" "
"	"	rice	"	36	"	" "

This shows that rice ranks highest and oats weakest in the elements to produce alcohol.

On an average, one bushel of grain yields about twenty gallons of beer, or four gallons of common whisky. Such is the statement of Duplais.

It is impossible to obtain full facts as to the amount of grain destroyed for this purpose, but the following will afford food for reflection:

There were in the United States, on a recent date, 1660 distilleries using 42,132 bushels of grain daily, or more than 15,000,000 bushels annually. Of the breweries, there were:

In the United States,	2,197	yielding	537,842,250	gallons.	
" England,	27,050	"	900,000,000	"	
" Germany,	25,902	"	990,000,000	"	
" Belgium,	1,250	"	210,325,000	"	
" Holland,	5,500	"	34,000,000	"	
" Russia,	430	"	68,000,000	"	
" Switzerland,	423	"	27,000,000	"	
" Norway,	400	"	13,500,000	"	
In Denmark, Sweden, and Italy,	620	"	530,000,000	"	

The above figures for the United States, taken from Hon. P. V. Deuster's speech in favor of the liquor interests, speak for themselves. From other sources

[1] The kilogramme represents about 2.2 lbs. and the litre 2.1 pints.

we find that the amount of spirits consumed in this country in 1879 was 50,865,007 gallons, while the amount of beers, ales, and porters was 344,622,378, and in 1884, 584,561,606. The liquors manufactured in 1884 amounted to 668,574,090 gallons, being an increase over the preceding year of 41,317,374 gallons.

The German State, Bavaria, the home of Bavarian or lager beer, is about 4000 square miles less in area than our State of Maine, and, in 1875, had a population of 5,284,578. It contains some of the richest lands of all Europe for agriculture, and produces 16,000,000 gallons of wine. It has about 5480 breweries, and annually turns 14,802,500 bushels of malt into 296,050,000 gallons of beer, which it consumes in greater quantity than any other nation on earth. In Munich the daily average is 1⅓ quarts per man, woman, and child, or 470 quarts each per year. Three quarts a day is an average amount for a "true Bavarian," while thousands of them strain their waistbands to accommodate eight quarts a day the year round. Though there is little of what is politely called drunkenness among them, the habit of beer-drinking causes want, idleness, disease, squalor, vice, and crime to abound. As an outcome of this habit, a great proportion of the people are too poor to marry under their laws, and hence, fully one-half of their children are of illegitimate birth—a scandal to all pretension to civilization.

The Beers and their Compositions.

When it is desired to use the product of fermentation as a beer, and not for distillation into spirits, a quantity of hops is added to the wort before fermentation, to give flavor and narcotic effect, and prevent the beer from souring. If the beer is to be kept for some time, a much larger quantity of hops is added, making *bitter beer.*

Beer is a very ancient beverage. Both Æschuylus and Sophocles refer to the *wine of barley* as early as 400 B.C.; so did the satirist, Archilochus, three hundred years earlier than they. Diodorus Siculus, who wrote B.C. 630, credits the king of Egypt, Osiris, with having introduced a fermented drink, made of barley, into that country, 1960 B.C., being before the call of Abraham. Julius Cæsar mentions beer in his history, 50 B.C. Though the discovery of it is credited to Egypt, that country seems to have ceased manufacturing it for a long time, till reintroduced by the French army, since which time it stays. From Germany it was introduced into Gaul. In the sixteenth century two kinds were brewed in France—one for nuns and the other for monks. At the time of Louis XIV there were seventy-eight breweries in Paris alone. Strange to say, it was not manufactured in Boston to any considerable extent till 1867—five years from which time it turned out half a million barrels, consuming a million bushels of barley and a million pounds of hops. In 1883, Massachusetts alone turned out 26,589,041 gallons, an increase during eight years of 11,721,534 gallons. In the same time the amount doubled for the whole United States, reaching 537,832,144 gallons in 1883; 584,561,606 in 1884, and 640,746,288 in 1886. During the year ending March 31, 1888, malt liquors increased 2,122,414 barrels over the previous year.

In Munich the use of hops is annually decreasing, while other substances are taking their place, to the great injury to the health of the people at large who indulge in the beverage.

Their Compositions.—The composition of beer, as given by Prof. E. A. Parkes, in his great work on "Hygiene," is as follows: 100 ounces contain 5 ounces of alcohol; 6 ounces of extractives, dextrine,

and sugar; 125 grains of free acids, and 65 grains of salt.

The last substance varies greatly, as it is often put in in excess to create thirst, that more of the beer may be consumed.

The great brewer of Boston, Mr. Reuter, testified that his beer contained 5 per cent. alcohol. Dr. S. D. Hayes, State Assayer of Massachusetts, gives Boston beer 4–6.3 per cent.; home-brewed hop beer, 5.5 per cent.; Ottawa beer, 5; and Edinburgh ale, 7.5 per cent. alcohol. That commonly drunk in Liverpool has 8, and Rochester beer, 5.6 per cent.

Ale appears to have been the general name for malt liquors before the use of hops was begun. Germany first introduced hops about 1524, and their name for hopped-malt liquor was *bier;* ale standing for the unhopped. Subsequently, hops were put into the ales, and they now differ from beer only in being of lighter color and having more sugar. Ales with mead—a drink prepared by fermenting honey and water—were the favorite beverages of the ancient inhabitants of Europe. The malt extract in ales varies from 4–15 per cent. Allsopps's has 6, Bass' 7, and strong ales, 8.65 per cent. alcohol.

Porters are dark beers, containing, according to Prof. Parkes, caramel and assama, and 4–9 per cent. malt extract; alum and copperas are added to make a high foam.

It is usual to consider the extractive matters of beers tonic and nourishing; and they, with the sugar, have been regarded as the cause of the fleshiness or, rather, the fatty bloating of the free drinkers. But, whatever the amount of nourishment they contain, we shall show that, not these things, but alcohol is "the cat in the meal" in this direction; that it is this that causes excess of oil globules in the blood, from which

they find lodgement in the cellular tissue, and that, too, quite independent of the extract and saccharine matters they contain.

Because they are bitter, they have been classed with other bitters as stomachics and tonics. Dr. Parkes says this is too great a concession. Certainly, delicate stomachs ordinarily rebel at them, and well they may; for Bungener, since supported by Dr. Dresser, found that the bitter principle of hops contained a crystaline acid, which in solution in spirit is a powerful poison, exceedingly destructive to small animals. It produces paralysis of the nervous system and heart, and greatly accelerates respiration in mammals.

Nor does beer, as is popularly supposed, aid digestion. Prof. H. A. Hare, of the University of Pennsylvania, made seventeen experiments, and every one of them very clearly showed that the beer acted the other way, retarding both the salivary and gastric digestion. Alcohol in any form, Prof. Duggan, of Johns Hopkins University, found retarded the digestion of starch in a marked degree. But beers are not simply for the sick; they are for the well, and why do they require tonics and stomachics? So much narcotic, mineral, and other harmful substances are contained in the extract of beers that so great an authority as the late Prof. Charles A. Lee, of New York, made no hesitancy in expressing his belief that malt liquors are more deleterious in their effects on the system than spirits.

The acids of beers—that is, of sound beers—are in their nature much like the other vegetable acids, and, like them, undergo like transformation into the alkaline carbonates in the blood, and, probably, would do very little harm were they not taken in excess by the frequent habit of resorting to this species of beverage.

But the frequency and the abundance in which they are taken render them obnoxious to the system, and the source of various disorders, like sour wines and other alcoholic drinks.

As proof of the inference above, I introduce an authority—that of Dr. Charles R. Brisdale, of the London Metropolitan Free Hospital, who expresses himself in the following language: "Well, I declare to you that the amount of gout and lung disease I have seen in London attributable to beer alone is quite distressing. At one time, chance made me chemical assistant of Dr. Garrod, a physician of repute in treating gout, and the number of poor working people that were crippled by gout through beer-drinking was then, for the first time, forced upon my observation, only for future experience to confirm. Seeing that many men consume several quarts of beer daily, we need not wonder that beer-drinking in London causes, as I have found so often, diseases of the liver, lungs, brain, urinary organs, and heart." Dr. J. Milner Fothergill is responsible for this: "No gouty man can drink malt and eat meat at the same time without paying the penalty." And Dr. C. B. Nancrede had a patient in whom a few glasses of beer brought on the piles. Dr. James Murphy reports a man of fifty who, in the course of two years, had forty-three vesical calculi removed, and got rid of this "breeding of stones" only by abandoning alcohol and saccharine matters.

It may be said that there are beers which have no acids. If so, they are rare, since bicarbonate of soda is freely added to them. There are many of the higher price which have no sugar—only a little acid, bitter extractive, and alcohol—thus leaving a very slim showing for their food-value, unless it be found in their alcohol, which is not likely to be the case, as we shall hereafter see.

Indeed, the nourishing quality of beer, under any circumstances, must be low; for, as an alcohol beverage, it has been the object to extend the alcohol as far as possible by the completest consumption of the sugar. Hence, only traces of sugar are found in the beer. Having little alcohol, it has been the purpose to get rid of as much as possible of the albumen and other nitrogenous compounds of the wort; otherwise, the beer will not keep. So, in the manufacture of Bavarian beer the fermentation is conducted under as low temperature as possible, when, according to Hassall, "the nitrogenous matter is wholly converted into yeast before all the sugar is decomposed." Bringing it down to a fine thing, there is little left in the best beer besides the alcohol and a portion of the bitter, non-nourishing extractive. Here, then, is good ground for the statement of the world's greatest physiological chemist, Baron von Liebig, when he asserts that it can be proved to a mathematical certainty that it would require the use of *eight quarts a day of the best Bavarian beer, for a whole year, in order to get as much nourishment as is afforded by three pounds of steak or a five-pound loaf of bread*—730 gallons—23½ barrels—nearly 3 tons in the shape of beer against 3 or 5 pounds in ordinary food.

Four horses were tugging hard on a load of beer passing my door one day, when I called the attention of my family to it, saying: "There goes Liebig's chicken!" When one thinks of a person getting a square meal on such stuff, and the gastronomic distention involved, he can hardly help thinking of the unhappy frog which aped the size of the cow by sucking in wind. That there is no nourishment in it is plain, or beer-men would get overfed. Mr. Thomann, in the liquor interest, furnishes statistics regarding 1000 men employed in breweries, and inad-

vertently exposes the unnatural guzzling practice of the employés when he gives the daily average number of their beer-glassfuls to be 25.73, or about 4½ quarts. Of these 1000 men, 85 drank 40–45 glasses; 45 drank 50 glasses; 1 drank 54; 14, 60; 1, 64; 2, 70; and 1 drank an average of 75 beer-glassfuls, or about 4 gallons a day. "Fallstaffian ponches" indeed!

But the kidneys are set to eliminate a little over three pints of fluid a day. What must be their work here? No wonder that the porter and ale brewers have lately divulged the fact that their workmen die off fast. But the great chemist, Liebig, stated that beer, as well as wine, spirits, etc., "furnish no element capable of entering into the composition of the blood, muscular fibre, or any part which is the seat of the vital principle."

The Corruptions of Beer.—To be fair with this agent, as with wine, there are some things to be said under this head.

We have seen that in the best beer, as the Bavarian or lager, it has been reduced as near as possible to a pure, weak alcohol, with nearly every vestige of food-quality removed from it. But while this is the ideal beer, that offered in the market is nearly always a very different thing. A malster confesses that if his customers knew what he really does, they would all leave him. Another asserts that there is hardly an exception to some form of cheat in New York. It is not strange, then, that Dr. L. Arcularius states that many Germans cannot stand New York beer very long. "This American stuff gives them headache, stomach-ache, and all sorts of aches." Another physician, of the same city, Dr. Messmer, says: "The lager beer sold in this city is not by any means a healthy drink." So Dr. Augustus Krehbiel asserts: "There is not a brewer who doesn't doctor his beer with something or other."

Really something is in it. Four glasses made a Brooklyn man shoot down Dr. Duggan in *cold blood*. Beer made a New York husband put a hole through his wife with a "22-calibre defender." Murder is in it. Who drinks lager beer is too apt to swallow the murder with it.

Numbers of both chemists and physicians assert that large quantities of *coculus indicus* are used in the manufacture of beer in some places. This is a berry which grows plentifully in the Indian Archipelago, and gives a dark hue and a rich, bitter taste to the beer. Its active principle is *picrotoxine*, whose physiological action is characterized by distinct delirious and stupefying effects upon the upper brain, causing epileptiform convulsions, followed by coma and insensibility. It benumbs the nerves so that the powers of sensation and motion are lost. It first excites the lungs and heart, but this soon gives way to depression and the loss of temperature. Upon the whole, its effects in beer resemble the action of the heavier alcohols in common spirits, rendering the beer much more intoxicating and dangerous. So good an authority as the late Dr. G. M. Beard, of New York, stated that the beer of the poorer class is largely drugged with this powerful agent. Mr. Phillips, a chemist, in 1863, found it twice in twenty analyses. *Marsh ledum*, or wild rosemary, is much used in North Germany, and acts in a similar manner to the coculus. In England saffron and clary are used for the same purpose.

A recent sample of London ginger-ale was of a bright pink color due to an arsenical substance, *rosaline*, which had been added. It would dye the stomach, as readily as it will dye wool, with a pink stain most difficult to remove. Tobacco is also sometimes added, which makes the old adage good: "One devil

does not come alone." But the liquor business is constantly evolving new tricks of trade, and the following from Dr. Böttern, of Fauborg, though long, is full of interest.

On February 24, 1874, four gentlemen, including himself, "supped in the evening at a friend's house, and at supper were treated to English beer. About a quarter of an hour after our repast we all began to feel unwell, with oppression in the region of the stomach and frontal headache. Shortly afterwards three of us were seized with violent retching, which was repeated in the course of the evening, and to which in my own case was superadded a profuse, watery diarrhea. Our attention was directed towards the beer when the servant-maid, who was in a similar predicament, declared that she had that evening taken nothing except a little of the beer which was left. The fourth of the party was for the first time seized with vomiting later in the evening; and in one case the retching continued through the night, whilst the rest of us slept well. Immediately after an attack of vomiting we felt much lighter, but the sense of oppression soon returned, and then the vomiting recurred. Before we separated in the evening we drank a strong cup of coffee; subsequently, we felt well. Next day we were all indisposed, with a sense of oppression in the gastric region, a burning heat in the head, thirst, and shivering fits; in one of the party rheumatic pains in the back and limbs were experienced. In my own case, towards the evening of the 26th, an abundant crop of lichen came out on the face, spreading over the whole body. But after five days it commenced to disappear under the use of warm baths and the mineral acids. My condition has in other respects, when I except the inconvenient itching and occasional shivering

fits, been good and the digestion in order. The servant, who was in the sixth month of pregnancy, still feels some heat in the head and has occasional vomiting—symptoms which have not since appeared in any of the rest of us.

"The beer was sent in casks from England, and was bottled in this town. Each of us drank only a small tumbler of it, and the servant finished what was left in one of the glasses. The beer was rather muddy, and had a somewhat flat but not acid taste. I presume that the bottle from which we drank was one of the last in the cask, to which fact are due the muddy appearance and the strong action. Our host and a lady, who had lately drunk small quantities of the same sort of beer, have occasionally suffered from slight frontal headache and cardialgia, with nausea, without being able to account for these sensations.

"The symptoms we were subject to on the evening of the 25th presented some similarity to poisoning by arsenic or copper; but it at once occurred to me that, as the beer was imported, it had been largely adulterated with one of those modern substances—*picrotoxin* or *colchicin*. With the kind assistance of Apothecary Berg and Candidate-in-Pharmacy Dons, *colchicin* was proved to exist in the beer which was still in the bottle we had drunk of, and in that contained in several other bottles."

Dr. Warncke had already recorded a case of such colchicum poisoning. His case was much more serious, attributed to the fact that the solution was more concentrated and probably taken on an empty stomach. Says Dr. Böttern: "The preceding meal and the speedy vomiting were in our case very important elements, so that in the course of a few days it is to be hoped we shall be perfectly recovered from the ill consequences detailed. That this was an in-

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stance of poisoning by adulterated beer is beyond all doubt."

Dr. Spiesz, of Frankfort, writes that while the production of beer has *quintupled* during the last ten years, the profits from hops have remained about the same. And as it has been proved by chemical analysis that the alkaloid colchicin, which is contained in *colchicum autumnale*, is used as a substitute for the bitter principle of hops, it is reasonable to suppose that colchicum is to a very large extent employed to adulterate beer.

Dr. Sedejack, of Munich, observes: "Since the invasion of cholera, on every evening on which most beer is consumed there is a direct increase in the extent of the disease—thus, on Sundays and Mondays a regular increase is found to occur, with a corresponding rise in the death-rate." He attributes this to the fact that other substances are used in place of hops in the beer.

"We are bound to remark," says the *London Lancet*, "that many of the liquors sold in this country are villainous compounds, and that if the beverages supplied to the working classes were of a superior character, or *if a taste could be developed among them for other liquors than beer and spirits*, the *amount of violent intemperance at any rate would be much diminished*"—a statement strangely at variance with the advocacy of beer on this side of the Atlantic.

However, if circumstances ever do occur in which it shall seem proper to give an alcoholic liquor, the "good old wine" has the first claim. But if it cannot be procured, as it generally cannot, or the price is too high for the means of the patient, then good beer is very eligible; particularly is it so for women, since, if spirit be prescribed, there is greater risk of their acquiring the liquor appetite, because it so

surely fosters neuralgias and other nervous perversions to which women are so commonly a prey. But beer is enchanting, and so able a man as Prof. Bunge, of the University of Basle, declares beer really to be "the most mischievous among alcoholic beverages, for the very reason that no other is so seductive." "Beer," says Dr. Felix Oswald, "leads to spirits or to heavy beer-guzzling, as in Munich. We cannot fight rum with lager beer. All poison habits are progressive."

If beer be selected it ought to be pure, and this is the rub. A reliable London physician asserts that London beer cannot be depended upon: it *is bad in a majority of instances.* Such, also, has it proved in this country, a very large per cent. being faulty, as the chemists have shown and the manufacturers themselves confess.

Of late, *salicylic acid* has come to be extensively employed, not only in beer, but in wines and other weak alcoholics, as a preservative, and as a consequence the streets do not smell as sour as they did. But salicylic acid is a potent drug, very irritating to the stomach, and particularly the kidneys, and should never be taken into the body except under the strict directions of a physician. France has already put it under ban, and made its use in beverages a penal offence, which should be the case everywhere.

Reviewing what I have now said on the subject, it is plainly to be seen that *the paramount object of the manufacture of beer is to produce an alcoholic drink;* that there are no other elements in the beer beside the alcohol worthy of notice, at best, not more than in bog-water or the suds in which the dinner dishes have been washed. Indeed, much more nourishment goes out of the sink-spout than down the neck of those who drink beer, and, if we could get

behind the screen, we should see it to be more wholesome, too. But the thought of drinking dish-water to which a little extract of hops is added, however full of food-qualities it may be, as compared with beer, is disgusting. Yet why more disgusting than the feelings which arise when we think that certain brewers endorsed and recommend a certain kind of pump because its valves will not clog when dead rats get in? We might as well face it. These pests do die in great numbers from the carbonic acid generated in the vaults by the fermentation, and, if we may judge by the pump advertisement, are a great nuisance in the way of the pumps.

Beer is not taken for anything but the alcohol in it; its effects for the most, except when sadly adulterated, are the effects of alcohol; for we shall see that the degeneration of tissue by its use is the same as from other alcoholic drinks. We therefore must conclude that *beer belongs in the category with other alcoholic beverages, and is to be judged of from its alcohol and from nothing else.*

In quitting beer we have to add what the great Reformer, Martin Luther, wrote of it more than three and a half centuries ago. His thoughts are applicable wherever this beverage is made. We cannot understand why any should attempt to popularize its use in this country except that when the stomach is full of German beer there is no room left for stronger alcoholic drinks. "The man," said Luther, "who first brewed beer was a pest for Germany. Food must be dear in all our land, for the horses eat up all the oats, and the peasants and citizens drink up all the barley in the form of beer. I have survived the end of genuine beer, for it has now become small beer in every sense, and I have prayed God that he might destroy the whole beer-brewing business, and the

first beer-brewer I have often cursed. There is enough destroyed in the breweries to feed all Germany."

3. *Distillation.—Ardent Spirits.*

We come now to consider alcohol in a less complicated state—one in which it has been mainly separated from the various compounds with which it was associated in the wines and in the beers.

The process by which this separation is effected is *distillation*, an art brought from the Orient, and first taught to Europeans by Albucasis in the twelfth century. A century later, its product was introduced by Arnoldus de Villa Nova into medicine, where it bore the name *aquæ vitæ*—water of life. For several centuries it was almost wholly confined to medicine before the sluiceways were opened, introducing it as a common beverage. The Irish came in before the English in the use of it under the name *usque betha*, a term expressive of its maddening influence on the brain, and from which our word whisky has come.

The process of fractional distillation is based on the fact elsewhere noted—the volatility of alcohol as compared with water. Hence, when such a mixture as wine or beer is heated in an apparatus so contrived as to gather the vapor and turn it back into a liquid, the first liquid which passes over is the alcohol with a certain proportion of water, which its affinity for water compels to go along with it. This done, the temperature rises forty degrees when the water is carried over. After this, a further rise of fifty-eight degrees reaches the boiling-point of fusel oil, and it goes over. But, since the affinity of these several substances causes them to mingle more or less in the successive stages, careful, repeated distillations are necessary to get an approximately pure article of any one kind.

The alcohol, so separated by keeping the heat below the boiling-point of water, will carry with it certain ethers and aromatic odors of the wines or beers from which it is distilled, which give a pleasant odor and taste to the liquor, or otherwise, as the case may be. Hence, the bouquet.

(1) *Whisky.*—This is the form of ardent spirits formerly distilled from rye grain, and hence its name, "Old Rye." In the Highlands of Scotland, barley was its source—*Scotch Whisky.* The celebrated *Kentucky Bourbon* is from Indian corn. As now used, the term whisky is applied to the spirit distilled from any of the grains or starchy roots, and is quite interchangeable with the term brandy, and has a strength of 48 to 56 per cent. of absolute alcohol.

After the wort has been fermented, the resulting liquor or beer is known as the *wash;* and the first distillation of this wash gives the *low wines.* From the redistillation of these low wines comes the regular "*raw corn juice,*" or whisky, the "*spiritus frumenti*" of the apothecary.

As we have said, certain volatile principles in the wort, or which are added during the distillation, appear in the spirit, and yield to it its characteristic flavor. Fusel oil or some other of the heavier alcohols is always present, in less or greater—sometimes very great—amount. But age has the effect of working a degree of chemical change in new whisky, so that some of its worst elements are mellowed, and partially disappear, to the improvement of the odor and taste of the liquor. In consequence of this improvement, it is required to be at least *two years old* for medicinal uses. A new process of aerating the liquor claims to work these changes in a comparatively brief time, and so save much expense to the manufacturer. According to Dr. Geo. B. Wood, "it

was introduced into the 'Pharmacopœia' as a cheap substitute for brandy, and may be employed for *all the purposes* which that spirit is capable of fulfilling. When of good quality, it is probably preferable as a medical agent to brandy, such as is now generally sold in our markets."

As a beverage, whisky is widely used; and a Frenchman has said "it is the best part of the American Government," a compliment not complimentary to true Americans.

The editor of the *Louisville Medical News*, who lives in the great centre of the Kentucky Bourbon, and must be supposed to know what he writes, says: "In former years, by the old-style sour-marsh process, one bushel of grain yielded by the natural fermentation one and a half gallons of whisky." But now, the greed of the distillers has urged them to increase this quantity by increasing the heat of distillation till "three, four, and even five gallons" are produced from a single bushel of grain. The liquor by the old process is, of course, comparatively free from the heavier alcohols, and, according to this writer, the modern, high-distilled Bourbon is "far more deleterious and injurious in its influence than absinthe." There is, therefore, ground for the cry often heard from old drinkers: "O, for the whisky of other days instead of the rot-gut of these times!"

But such is the general corruption of the liquor trade, that even whisky, poor as it is, cannot be let alone, but is often compelled to do dirtier work than that to which it is naturally inclined. To this the following bears witness: Only recently, a quantity of whisky was seized in the neighboring city of Newton, and, as good luck would have it, the recipe was obtained by which it was made, running as follows: "Ten gallons of kirosine; three pounds of potash; one

ounce of strychnine; mix with soft water," but just how much is not stated. The directions further say: "If you want gin, add *quantum sufficit* of oil of juniper."

The advocates of the modern process for ageing liquors frankly acknowledge that the old way opens such temptations as cannot be resisted of mixing them "with matters foreign to their nature, etc., to the great advantage of the trade and the disadvantage of those who are compelled to use them." "If this is the case," say they, "with those sold by druggists and dealers who supply them, who are supposed to keep the best, how much more injurious and impure are those sold by the trade generally?"

(2) *Gin.*—"Old Geneva," or gin—a contraction of the word—is simply a grain spirit like whisky, only turpentine or the oil of juniper berries has been added to the vapor of the spirit as it was passing through the still. It is an ardent spirit of about 51 per cent. alcoholic strength, to which the aromatic oil is added for the purpose of covering up and disguising the more unpleasant odor and taste of the raw spirit, and not for any supposed diuretic effect it may have. There may be less drunkenness by reason of the mixture, but the kidneys are specially in danger from it. By reason of this disguise the liquor is earlier got into the market, and a poorer quality sold.

It is not *officinal*, and not prescribed in regular medical practice.

The following formula for making the *compound spirit of juniper*, however, is recommended. It is evidently intended to secure the diuretic qualities of the preparation while it excludes the fusel oil of the common gin. This formula is as follows: Dissolve one and a half fluid drachms of the oil of juniper, and ten minims each of the oil of carraway and

fennel in five pints of alcohol, then add three pints of water to make a gallon.

The gin of Belgium and the north of France is whisky from barley and potatoes. The Norwegian and Swedish gin is simply a tincture of juniper berries, made by putting the berries into the spirit after its distillation to soak. It is a sharp, disagreeable spirit of 50–55 per cent. alcohol. The gin used in Holland is 45–49 per cent. strength, and the little town of Schiedam has more than two hundred distilleries constantly at work turning out "schnapps."

(3) *Brandy.*—This spirit, if properly made, is produced by distilling off the alcohol from wines, and is of the same strength as whisky, viz.: 48–56 per cent. The œnanthic ether and other volatile aromas of the wine from which it is distilled go over with the distillate, giving it as great a variety of flavors and odors as the wines from which it is taken. It is, therefore, if properly made, less harmful and more agreeable and more astringent than whisky.

When first made, brandy is colorless, and, if bottled, will remain so. Ordinarily, it is put into oaken casks, from the wood of which it takes tannin, and gets both color and astringency. Caramel, added, gives it a deeper red appearance.

For medicinal uses, brandy is directed to be free from a disagreeable odor, and *not less than four years old.* But being "processed," as it is called, it is now put upon the market in a few days. Being from wine, all sorts of wine are made to produce it, and it gets names accordingly. Thus, we have apple brandy, perry, peach, cherry, etc. *Rum* is nothing else than molasses brandy. In 1883, in the United States, 2,373,106 gallons of molasses were made into it.

Its Counterfeits.—Besides these sources of brandy, which are legitimate, all kinds of alcoholic liquors

are compelled to yield this high-priced beverage; even spoiled beer has to surrender its portion of alcohol for this purpose. With brandies, equally as with wines, "things are not what they seem."

The State Chemist of Ohio, in the course of two years, made above six hundred inspections, and found 90 per cent. spurious.

Two samples, bought for the best for medicinal purposes, were examined by him in the court-room at Cincinnati, and the liquor was purchased in New York. The polished blade of a knife was placed in it for fifteen minutes, when it changed the blade to the color of copper, and the liquor became black like ink. Nitric acid, sulphuric acid, prussic acid, Guiana pepper, and fusel oil were among its ingredients. The court condemned the liquor, and the New Yorker, who sold the stuff and sued to recover, went home without the money.

Dr. William A. Hammond, of New York, who, in his "Treaties on Hygiene," classes alcohol with foods, though of low status, observes: "So generally is it, brandy, adulterated, that it may be laid down as almost a certainty that, unless the sample can be traced throughout its whole course, from the moment it left the still to the time it is offered for sale, the probabilities are immensely against the fact of its being a pure article. The greater portion of the brandy of the United States is made here from whisky, and nine-tenths of the rest is manufactured in France or England in the same way. Liquors called brandies are thus made which are not worth a ninth part as much as brandy."

Of every thousand gallons sold in England, a reliable authority pronounces nine hundred and ninety-nine vile compounds.

U. S. Consul George Gifford, at Bordeaux, writing

from La Rochelle in 1882, after an extended inspection, states: "All French brandy might, and perhaps ought to, be excluded from the United States on sanitary grounds. A general measure excluding the article entirely would seem, therefore, to be the only effective defence against the admission of a poison for which our people pay one or two million dollars a year, besides the import duty, which, in case of the impure article, is over 100 per cent. of its invoice value." "No pure French brandy is sent to this country. The age stated on the bottles refers not to the actual age of the contents, but to the fact that the concoction is made to resemble supposed liquors of that age, and are only counterfeit chemical compounds." "The liquor laws of France apply to liquors produced for home consumption, and not at all to the fraudulent compounds for exportation."

The brandies exported from Portugal are equally bad. Duplais, whose late work is the ablest I have read on the manufacture of alcohol, shows that it pays better to use the product of the grape as a wine, and particularly so since the price of genuine brandy is at present so much underbid by the undetectable counterfeits which flood the market. For the production of these counterfeits, he gives a formula for all the standard and high-priced kinds; and he gives them as frankly as if he felt that such manufacture was a legitimate business, and the spurious kinds equally good with those imitated. Would you make your own good old Armagnac, say one hundred litres of 49 per cent. strength? Then take, as he directs:

85 per cent. alcohol of good flavor .	56 litres.
Common rum	2 "
Syrup of raisins	2 "
Water	40 "

Dried liquorice root	500 grammes.
Black tea	60 "
Cream of tartar	2 "
Boracic acid	1 "
Caramel (burnt sugar)	q. s.

This brandy would not require four years to get it ready for use.

If you prefer to make a fine, delicious Cognac of the same quantity, the following will do it:

Alcohol at 85 per cent.	54 litres.
Rum of good quality	2 "
Syrup of raisins	3 "
Infusion of green walnut hulls	2 "
Infusion of the shells of bitter almonds	2 "
Catechu in powder	15 grammes.
Balsam of tolu	6 "
Pure water	27 litres.
Color to fancy with caramel.	

Occasionally red sanders wood is added to brandy, though not often, since caramel produces the most powerful color and has the least taste. Says Cooley, in reference to coloring the liquor: "The original intention was doubtless merely to imitate the appearance acquired by brandy from great age when kept in wood, but in process of time the thing has come to be overdone. The natural color which the spirit receives from the cask, however long it may be kept, never exceeds a light amber tint; but the public taste has gradually become so thoroughly vitiated in this respect that only a spirit of a lively and full *brandy color*, as it is called, will now please the masses." Says Prof. J. F. Babcock, of Boston: "*All very dark brandies are artifically colored.* The same remark applies to rum and whisky."

Prof. Babcock gives a formula for a brandy, which has not a particle of brandy in it, which is excelled only by the finest Cognac, and which he says is vastly

superior to ordinary brandies. It is as follows: Alcohol, 49 per cent., twelve gallons, to which five gallons of water are added; three-fourths pound crude cream tartar, dissolved in one gallon of boiling water; six fluidounces of acetic ether, two quarts of wine-vinegar, and five pounds of bruised prunes, and also a small quantity of the oil of Cognac (which is distilled from the lees of wine) for flavoring. After the mixture has stood a fortnight, with occasional shakings, fifteen gallons are distilled off and put into a clean brandy cask, and one pound of oak shaving added to give the necessary astringency. After another week the liquor may be drawn off, and in time cannot be distinguished from the genuine article, only that it is likely to be better.

California brandy is made from the lees of wine, the marc or refuse matter of grapes, after the juice has been pressed out, and poor wines distilled together, after which burnt sugar is added.

In this manner, which appears legitimate, according to Duplais, the floodgate is open to produce an imitation of the product of any vineyard, and yet not a particle of the juice of the grape be in the brandy, and the alcohol itself might have come from daffodil or beet-root, or almost any other source.

What wonder is it, then, that a Hebrew should be emboldened to plead his own cause in a Boston court, when charged with having liquor unlawfully on hand for sale? "The wine was bought for family use on Friday, and some of it was left over. The whisky was a Christmas present." "Then, how about the brandy," said the judge. "Dot vas not brandy at all, your honor; it vas sacred viskey, used at the Passover, made out of bodadoes in Jerusalem."

This brings me to a repetition of what I have already said, only that I now speak with more em-

phasis, namely: *That the production and use of an alcoholic liquor turns entirely upon its alcohol; and that whether the other ingredients usually found in the preparations were naturally there, or artificially added, is of no matter of account. Whatever be their origin, they are only as the sugar-coat on the pill—to help it down.* And this is just the point Dr. Edward Smith, of London, reached years ago: *That the alcohol, bevond all other things, is the thing for which alcoholic liquors are employed.* And to avoid adulterations and have things to be in reality what they are pretended to be, he goes straight to alcohol itself for medical purposes. Dr. Samuel Wilks, of Guy's Hospital, does the same, and advises the use of real alcohol properly diluted. Dr. Smith would have the alcohol taken which comes over in the first part of the distillation, because it is freer from fusel oil and other heavy impurities, and is more fragrant on account of the greater amount of the ethers and other volatile aromatics of the liquor distilled. Dr. Wilks selects the alcohol, dilutes it to the strength of whisky, and then colors and flavors it with the compound tincture of cardamons.

Prof. Elias H. Bartley ("Text-book of Medical Chemistry," used in Harvard Medical College) shows the varying strength of alcohol compounds, and considers it a very uncertain way to prescribe any one of these beverages. "A much more certain method," says he, "is to prescribe alcohol of known strength, flavored with ethereal essences, and softened with glycerin or syrup." He declares that "all alcoholic beverages are subject to gross adulterations," and that "there are no conclusive arguments to prove the benefit to be derived from the use of alcohol in health."

A writer in *New Remedies* for March, 1876, contends, sharply, for the regular *raw corn whisky or high-*

wines as being both pure and cheap, though somewhat lacking smoothness, oiliness, and body. He asks: "What is there to be gained by running the unnecessary risk of inculcating a taste for the truly fragrant bouquet of choice French brandies, or the almost equally precious old Kentucky Bourbon?"

This is really the short way to the matter, so that the physician may know what he is prescribing. If anything is wanted which is not in the alcohol, it can very readily be added, while such ingredients as are objectionable in ordinary spirits are not present to trouble.

In June, 1885, Dr. Henry Leffmann, of Philadelphia, read an able paper before the College of Physicians and Surgeons, in that city, in advocacy of the same practice, and introduced Dr. A. W. Miller, a chemist, who supported him, and showed various samples to this end. They both recommended the adoption by the profession of a standard pure spirit made from corn, which they named *spiritus maydis rectificatus*, in place of the countless things now sold.

A resort, then, to straight alcohol from a particular source, and of a standard strength, would avoid the dangers of the thousand-and-one adulterations, falsifications, and other impurities, and be far the cheapest and the best. Would physicians generally see it so, and act accordingly, they would make a long stride towards the exactness they claim and get a strong grasp on the throat of empiricism, and at the same time serve the cause of temperance a thousand-fold better than by turning floods of beer and wine upon the public, as has been so eloquently urged.

(4) *Absinthe.*—At Lyons, Montpellier, and Portalier are manufactured large quantities of a liquor under the name of Swiss absinthe. It is more than an alcohol. It has, added together, the power of two

or more substances which work in conjunction. Absinthe is the *distilled tincture of wormwood*, the botanical name of which is *artemisia absinthium* (from the latter of which it takes its name), and fennel and anise. As an alcohol it is of great strength, being from 72–74 per cent., and is characterized in its action by both the alcohol and the essential oil of wormwood, with which the effects of the fennel and the anise join.

The oil of wormwood, sparingly extracted in the common infusion known as wormwood tea, is freely taken up by the alcohol in the common preparation in this country—*wormwood and rum.*

This oil possesses striking narcotic properties and the still more striking power of producing epileptiform convulsions. M. Marcé found that its administration to dogs and rabbits by the stomach would produce "trembling, stupor, hebetude, instability, and all the appearance of extreme terror," and, though thrown into convulsions, they usually recovered. M. Magnan observed the same effects. When given to guinea-pigs, so as to produce convulsions, they did not recover. Dr. R. Amory, of Boston, witnessed like effects. Moreover, when animals were killed by it, he was unable to find any particular lesions, except slight congestion of the brain.

It is observed that the effects of absinthe differ quite widely from those of pure alcohol, so that the series of its peculiar phenomena have obtained the name of *absinthism*; and separate experiments with the oil and with alcohol have demonstrated that the peculiar phenomena are due to the oil. Hence, absinthe is a more potent liquor than alcohol alone, and more dangerous, being capable of producing speedily fatal results.

Absinthe is a fearful drink. So terrible are its ravages among the French people who use it, that the

French physicians have been compelled to warn the nation against its use. Duplais says of it, even when diluted with water, "it is most deleterious to the animal economy." In its pure form it gives rise to serious disorders of the stomach and the brain.

Dr. Robert Amory, of Boston, experimented with it, and reported the results in the Boston *Medical and Surgical Journal* for 1868. These are some of his statements: In excess it "causes restlessness at night, with disturbing dreams, nausea, and vomiting in the morning, with great trembling of the hands and tongue, vertigo, and a tendency to epileptiform convulsions, in which the patient loses consciousness, falls, bites his tongue, foams at his mouth, makes facial grimaces, throws about his limbs, etc., but from which he usually recovers."

In a lecture given by Dr. Debourge at Brussels, he took occasion to show its deadly nature by experimenting on fish. Selecting two similar vessels, of about a pint each, he filled the vessels with water, and put into them some little fishes. Into one vessel he dropped six drops of prussic acid, and into the other, six drops of absinthe. The fishes in the latter perished first.

M. Magnan found, that while the fumes of alcohol would only intoxicate guinea-pigs, the fumes of absinthe would throw them into convulsions.

Now, this is the drink which they who live in the richest vinelands of the earth, and with whose product they have all their life been familiar, have prepared for themselves. Verily, light wines are not a safeguard against stronger beverages, and an argument based on them is not the argument which the people of this country will accept as the proper prevention of worse drinking.

Other Alcoholic Liquors.—The following are some

of the other forms of alcoholic drinks which people in different parts of the world have devised for their indulgence and degradation:

Name of Liquor.	From What Made.	Where or by Whom Used.
Araki	Dates	Egyptians
Arrack	Rice—the Areca-nut	East India, Ceylon
Bojah	Elusine Corocana	India
Bouza	Millet	Abyssinia
Branvin	Potatoes and grains	Sweden
Cana	Sugar	Coast of Mexico
Calla, a sour wine	Cocoanut palm	East Indies
Chica	Maize and spittle	South America
Kaffer beer	Indian corn	South Africa
Kawa or kava	Macropiper (long pepper)	Islands of the Pacific
Kirschenwasser	Black cherries	Switzerland
Koumiss	Mare's milk	Tartars
Lagmi	Date palm	Africa
Leban	Milk	Arabians
Mahwah arrack	Flowers of the Madhuca tree	India
Maraschino	Macarska cherry	Dalmatia
Mastica	Rum flavored with mastica and brandy	Constantinople
Mescal	Distilled from pulque	Interior of Mexico
Murwa	Elusine corocana	India
Neva	Palm	Sumatra
Pulque	Argave, or century plant	Mexico
Quass, or rye beer	Rye and barley flour, mixed	Russia
Rakee	Rice, figs	Turks, Greeks
Sacie, or sake	Rice	Japan
Shamshoo	Rice	China
Silvovitz	Prunes	Austria, Hungary
Slatkaia trava	Sweet grass	Kamtschatka
Tepache	Pineapples	Mexico
Toddy	Cocoanut	India, Ceylon
Vodki	Potatoes	Russia, Poland
Yaourt	Milk	Turks
Ywera	Tee-root	Sandwich Islands

"*Bitters*" *and* "*Tonics.*"—Still another form of

alcohol deserves a passing notice. I refer to the *drugged alcohol* sold under the name of "bitters" and "tonics," and issued to the world in flaming garb and under a false mask. It is loud-mouthed and arrogant. With huge effrontery it pleads under every window and at each man's door: "*Buy me and I will do you good.*"

Several years ago the State Assayer of Rhode Island gave attention to many of these, and reported to Sheriff Holden; and the Analyst of the State Board of Health of Massachusetts reported, in 1887, having gone over part of the same ground and beyond —including some of the "tonics." These two reports are blended below, and the initials over the figures show to which they belong, while a few foot-notes indicate "how well they talk."

PER CENT. OF ALCOHOL IN POPULAR "BITTERS" AND "TONICS."

		A.M.B.H.	A.R.I.
Armington's	Bitters		33.26
Atwood's (L. F.) Jaundice	"	22.3	25.60
Atwood's (Moses) Jaundice	"	17.1	
Atwood's Quinine Tonic	"	29.2	40.10
Baker's Orange Grove	"		25.70
Baxter's Mandrake	"	16.5	
Boker's Stomachic	"	42.6	40.57
Brown's Iron	"[1]	19.2	
Burdock's Blood	"	25.2	
California Wine	"		18.2
Carter's Physical Extract	Tonic	22.	
Carter's Scotch	Bitters	17.6	
Clark's (Dr.) Sherry Wine	"		22.40
Colton's Nervine	"	27.1	29.73
Copp's White Mountain	"[2]	6	
Davis's	"		30.50
Drake's Plantation	"[3]	33.2	30.34

NOTES FROM LABELS ON BOTTLES.

[1] "Not a substitute for whisky."

[2] "Not an alcoholic beverage." "Wineglassful."

[3] "Contains St. Croix rum." "Wineglassful three times daily."

		A.M.B.H.	A.R.I.
Fisch's (Dr.)	"		32.16
Flink's Quaker	"	21.4	22.29
Goodhue's	"	16.1	
Hartshorn's	"	22.2	37.35
Hibbard's (Dr. R. F.) Wild Cherry	"		35.89
Holland's (Dr.) German			20.85
Holme's (Dr.) Golden Seal	"		34.24
Hoofland's German	"[4]	25.6	
Hoofland's German	Tonic	29.3	
Hooker's Wigwam	"	20.7	
Hop	"	7.	
Hop	Bitters	12.	
Hostetter's Stomachic	"	44.33	43.20
Howe's Arabian	Tonic[5]	13.2	
Jackson's Golden Seal	"	19.6	
Kauffman's Sulphur	Bitters[6]	20.5	
Kingsley's Iron	Tonic	14.9	
Langley's (Dr.)	Bitters	18.1	24.41
Liebig's Co.'s Coca Beef	Tonic[7]	23.2	
Liverpool's Mexican Tonic	Bitters	22.4	
Luther's Temperance	"		16.68
Mensman's Peptonized Beef	Tonic	16.5	
Mishler's Herb	Bitters		36.80
Oxygenated	"	None	19.28
Parker's	Tonic[8]	41.6	
Pierce's Indian Restoration	Bitters	6.1	6.36
Porter's (L.) Stomach	"	27.9	
Puritan	"		25.60
Restorative	"[9]		20.54
Richardson's (Dr.) Concentrated Sherry Wine	"	47.5	59.14
Rush's Bitters for the "Stomach's Sake"		35.	34.30

[4] "Entirely vegetable and free from alcoholic stimulant."

[5] "Not a rum drink."

[6] "Contains no alcohol." It really has no sulphur.

[7] "With sherry."

[8] "Purely vegetable extract, stimulus to the body without intoxicating." "Inebriates struggling to reform will find its tonic and stimulating influence on the nervous system a great help to their efforts. One to two tablespoonfuls one to three times daily."

[9] "Tablespoonful to half a wineglass or more three times daily, or when there is sensation of weakness or uneasiness at the stomach."

		A.M.B.H.	A.R.I.
Schenck's Sea Weed	Tonic[10]	19.5	
Secor's Cinchona	Bitters	13.1	
Shonyo's German	"	21.5	
Speer's Standard Wine	"		25.49
Sweet's (Dr. Job) Strengthening	"	29.	31.41
Traveller's Peruvian	"		22.40
Thurston's Old Continental	"	11.4	
Walker's Vinegar	"	6.1	7.50
Warner's Safe Tonic	"	35.7	
Warren's (Dr.) Bilious	"	21.5	29.60
Webber's Strengthening	"		26.87
Wheat	"	13.6	
Wheeler's Tonic Sherry Wine	"	18.8	14.66
Whitcomb's (Faith) Nerve	"	20.3	
William's (Dr.) Vegetable Jaundice	"	18.5	

The above long list of "bitters" and "tonics" is produced that any who wish may have chance to see what their proportion of alcohol is as certified to by responsible chemists. Surely, this great amount of the intoxicant is not necessary for their preservation, since 20 per cent. is sufficient to preserve almost anything. Why, then, is it there, but as an appetizer for the preparation itself, that he who begins may have created a desire to continue its use?

According to the Rhode Island assayer, "Richardson's bitters" contain more alcohol than the strongest brandy, approaching absinthe. Several of them are stronger than the common tinctures of pharmacy, and many more exceed in strength the highest fortified wines.

"Beef, Wine, and Iron" is of the same sort, and peculiarly dangerous, especially to women, on account of the other ingredients which are so tempting. Yet the best authorities to-day contend that there is

[10] "Distilled from seaweed after the same manner as Jamaica spirit is distilled from sugar cane. It is, therefore, entirely harmless and free from the injurious properties of corn and rye whisky." "Half-wineglass three times daily."

no nourishing quality in the beef-extract such as is here used; hence, the compound turns solely on its iron, which, being inert above a small per cent., allows the liquor element to be taken freely. It is an unscientific and unworthy compound. "Vegetine" also belongs here; for, though not nominally a "bitters," Dr. Albert Day, of this city, stated at a medical meeting that he had been called to a person in delirium tremens from drinking it.

"Reed & Carnrick's liquid peptonoids" contain above 15 per cent. alcohol, though claiming to be "concentrated beef and milk with gluten perfectly digested." "Murdock's liquid food" is about one-third whisky.

Now, this was the alcohol which proved so great a curse in the days of the original "Maine Law" in that State. And one man confessed to me that he had kept a community well supplied with drink by smuggling in alcohol, diluting and adding gentian and other disguises to it, and then flamingly advertising the "bitters" over the name of an invented "Prof." Not only is the character of these preparations open to criticism, but also their mode of introduction to the public.

A while since a good and true man approached the world's greatest operator in this line of "medicines," to inquire how he might best get a good thing, which he had, upon the market. "I don't care whether the medicine is good for anything or not," replied the medicine man, "that has nothing to do with the sale of it whatever. The only thing to be considered is how much money do you want to put into it? How much will you advertise it? That is all." The young man turned away in disgust and threw his formula into the fire.

So it is. The great power of the press is prostituted

—even religious journals selling their space and high influence—to push the sale of these villainous concoctions, forcing them, not only upon those who have begun to drink, but into the homes of unsuspecting women and children, who would spurn the saloon, and, under the most specious pleas, persuade them to take the pretended "medicines" in which the boasted drug is but the bait upon the barbed hook of the alcohol beneath, which, once fastened, compels its doomed wretches to go again and again to their "medicine" till hankering for strong drink becomes their ruling passion, and drags them down.

Arriving here on an eminence, a moment's observation may be indulged. In front, the path descends into the labyrinths of the human body. In my rear, spread out the vineyards, the orchards, and the fields for grain, through which the way has lead, and in the midst of which stand so conspicuously, the wine-press, the brewery, and the smoking distillery—human devices for the destruction of the precious annual yield. Looking back upon this scene, certain thoughts spring up, which will serve for serious reflection as I go on:

1. Alcohol is produced at the expense of what is or may be food. Its production, therefore, to any considerable amount is an evil—a blight upon our God-given harvests, a sin against the people.

2. It is the essential ingredient, with few exceptions, in all alcoholic preparations, whether as wine, beer, or any other form. It is their *sine qua non.* It determines their strength and their power for good or ill; without it they would be without value, and cease to be made.

3. Genuine articles are rarely made and more rarely sold, while adulterations, sophistications, and other corruptions abound, which shows the whole liquor

business to be little better than a public fraud—a standing cheat.

4. Alcohol is a two-edged sword. One edge, applied to bread, cuts off the chief necessity of life, rendering subsistence difficult and life a struggle, and, by consequence, sends misery, wretchedness, hunger, sickness, death. The other edge, applied to the person—as we shall soon see—smites down through the tender organism of him who drinks it, and cleaves him from head to foot.

UTTERANCES OF WISDOM.

DR. J. MILLER, F.R.S.C., Surgeon to the Queen for Scotland: "It would seem as if alcohol, circulating in the blood, to a considerable extent suspended, for the time, the chemico-vital processes proper to the fluid in its normal state."

DR. B. W. RICHARDSON, F.R.S.: "The true character of the alcohols is that they are agreeable temporary shrouds."

DRS. LALLEMAND, PERRIN, AND DUROY, Professors at Valde-Grace: "Alcohol is eliminated from the organism in totality, and in its natural state."

GEORGE K. SABINE, M.D., Member Massachusetts Medico-Legal Society: "Many alterations in the functions are recognizable after death by a change in the tissues, but there are various affections, which point to a marked change in the cerebro-spinal system that cannot be detected. The very delicate and complicated structure of the nerves and ganglion cells require not only that their anatomical but also their chemical relations be preserved for the performance of their functions. Ever so slight a deviation in the nutritive processes produces a disproportionate disturbance in their functions. No organ, except the liver, suffers such a variety of lesions from alcohol as the central nervous system."

JAMES L. PERRYMAN, A.M., M.D., of Illinois: "Alcohol is no more the gift of a beneficent Creator than small-pox, yellow fever, diphtheria, measles, typhus, typhoid, leprosy, or any other contagious or infectious disease. Alcohol passes through the animal economy unchanged, scorching, burning, disorganizing, paralyzing, and breaking down, sooner or later, every tissue it comes in contact with."

PART II.

Alcohol: Its Way Through The System, with Observations by the Way—Physiological, Pathological.

HAVING considered alcohol as to its origin and various compounds, our future studies will be chiefly confined to it in its action. But before we go further we must note :

I. Three Preliminary Principles in Relation to Alcohol,

which are as vital in its study as are axioms in the study of mathematics. They are mobility, affinity, and osmose.

1. MOBILITY OF ALCOHOL.

We have seen that its specific gravity is .796, or something less than four-fifths as much as water.

Now, it is a law in chemistry that the lighter a fluid is the more easily do its particles move among themselves and become diffused abroad. This law applied to alcohol prepares us to expect to find it penetrating and permeating the body as only a few other substances will, and afterwards escaping by vapor. Ether is similar in nature and lighter than alcohol, and possesses a greater power of diffusion, but, having a stronger odor, we can pursue its course much longer than we can alcohol. Hence, it becomes a valuable collateral aid in helping our reason to hold on to the trail of alcohol in the body long after our senses have failed to detect its scent.

II. AFFINITY OF ALCOHOL FOR WATER.

Referring to what has been said on this point, we find that this attraction is so great that a mixture of the two results in the shrinkage of bulk near 4 per cent. and the elimination of a considerable amount of latent heat. This affinity leads it to seek water wherever it exists in the body and to draw it out of its normal relation to the tissues, thereby changing their appearance, condensing them and crippling their functions till the habit converts the body of the young man into the decrepitude of age. Moreover, the more watery the part is the more readily does this affinity lead the alcohol to attack it. So, as the brain is the most watery of any of the tissues, we may reasonably expect that spirit will attack it with fiercest heat, as it is found to do, and that without assuming that it has any special elective affinity for brain and nerve matter as such, as certain scientists have supposed. Indeed, such an assumption is a jumping the track. This affinity is one of the most important facts of alcohol, and will be more fully developed by and by.

III. OSMOSE IN RELATION TO ALCOHOL.

Osmose is a principle described by Dutrochet in 1837, and applies to the tendency of liquids or gases having different densities to pass and repass through an intervening membrane to mingle with each other on the opposite sides. This principle is governed by two conditions: 1. Attraction of the liquids for each other, in which case the passage is greater from the lighter to the heavier than from the heavy to the light. Thus, of plain water on one side of a pig's bladder, for instance, and salt and water on the other, more of the water will pass to the salt and water than of the brine through to the water, so

that the brine will be diluted and its bulk increased, while the plain water will be rendered brackish and diminished in quantity. 2. The second condition is, the attraction which the fluids have for the substance of the intervening membrane; that which attracts the most passing the most freely, other things being equal.

Now, alcohol is lighter than water; so, according to this rule, we should look for a greater absorption of it; but the reverse is the truth, and this is owing to the much greater attraction of water for animal tissue than alcohol has. Indeed, so great is this difference of attraction of these two fluids for the membrane that a considerable more of the water will pass, though heavier, than of the alcohol. This is a fact of the first importance, and goes far, as we shall see, in explaining the rôle of alcohol in the animal body. I wish to be emphatic here, since former writers have not sufficiently developed this point, and consequently have drifted into theory, when they might have been guided by facts and kept from erroneous conclusions.

I have the bladders of two kittens, holding about four drachms each, with which I have made many experiments. By times I have filled them nearly full with alcohol and water and placed them into plain water and seen them swell. Again, I have filled them with water and put them into an alcoholic mixture, and they have shrunk and shrivelled, teaching a great lesson respecting the physiology of alcohol upon the blood globules, to be hereafter studied. It is precisely this property of alcohol to draw water out of animal tissue which explains why the microscopist uses it to harden his otherwise soft specimens for the microtome, and why the pathologist employs it to make the brain and nerves firm

that he may handle and dissect them. Now, precisely what it will do for tissue and brain matter out of the body we shall find it will do for the same in the body.

There are other facts growing out of this difference of attraction between alcohol and water for animal tissue. One is that in a dry atmosphere surrounding the bladders, the one containing the water will give that water up by evaporation through its walls 8 to 1 faster than the other will give up alcohol. But this difference, though great, is not so great when surrounded by a moist atmosphere or a watery medium. This also explains how certainly watery tissues must shrink in its presence, and prepares us not to expect it to be readily eliminated by the processes of secretion which involve the principle of osmose.

II. How Alcohol may Enter the Body.

There are several ways by which alcohol may be introduced into the organism; still, the general effects are the same. Only three of these ways are of interest here—by the skin, the lungs, and the stomach.

I. By the skin—its local effects.

That certain substances may enter the system through the skin needs no argument. Physicians recognize this and act upon it. A common practice among French physicians is to use wine poultices, an application which frequently produces intoxication in children. Wine compresses have done the same, and have even been charged with creating an appetite for strong drink. Racle, however, intimates that this untoward result arises more from inhaling the vapor emanating from the application than from absorption by the skin. In either case suggestion is offered that great care be taken in their use, and that they be employed for the shortest time possible.

But how must it be with infants and small children living in the rooms and sleeping in the foul beds of drunken parents, nurses, or friends, with whom they must spend their nights as well as days, and be breathed upon by the pungent breath of their liquor-soaked attendant? Swaddled in such an atmosphere, how can they fail to suffer harm? If the child is quiet it is because it is half drunk from absorption through its pores and its lungs. Poulticed, as it were, from head to foot with such foulness, what wonder that the child starts off on the wrong road; and especially so since a Committee of the Royal Medical Society have determined that agents introduced by the skin have a fourfold force over the same agents administered by the mouth? Is it any wonder that such children are sickly and die early, or, if they grow up, they as readily take to strong drink as the duck takes to the water? The inclination in such cases is not natural: it is acquired, and the parents are solely responsible for it. They may not have thought that they, by this means, were as surely perverting the constitutions of their little ones as though they fed the liquor to them. Yet it is so. It takes but a dew-drop to bend the twig and pervert the oak. So it takes but the wreaking breath or bed of a drunken person to change the tender child so as to pervert his manhood, and nature is charged with the account.

Strong alcohol is a direct caustic to the skin, and will blister if confined to the part but a few minutes. On abraded surfaces and on the eyes and the mucous orifices generally, it coagulates the fibrine and albumen, and shrinks and consolidates the parts by its great affinity for their moisture. Poured upon the sound skin and fanned, or under other circumstances favoring rapid evaporation, it cools the surface and

renders it white by driving the blood from the capillaries; and the vasomotor nerves, or the nerves which preside over the coats of the vessels, soon become paralyzed. Then dilatation, congestion, or engorgement ensues, and at the same time there is suppression of the gaseous interchange between the blood and tissues—a state which, according to Gubler, cannot be continued long without destroying the life of the part.

Two cases of fracture of the leg have come to the writer's knowledge where by carelessness the doctor allowed the alcohol used to get beneath the dressing, producing most painful results. The weaker the spirit the less irritating it becomes and the less harm it does, while it is cooling and mildly anodyne. By reason of the power of alcohol to coagulate albumen it is dangerous to use it strong hypodermically. Weak portions only can be so given. It has been injected into serous cavities for the purpose of drying up their secretions and producing cohesive inflammation; but other substances are better than this and to be preferred.

II. ALCOHOL BY THE LUNGS.

Like ether and chloroform, alcohol may be inhaled, and so produce an anesthetic intoxication. Orfila poisoned dogs by its vapor. Dr. A. S. Taylor, in his work on "Medical Jurisprudence," cites the case of a child two years old which was thrown into convulsions by breathing the vapor of *eau de Cologne*. Marcet instances a seller of liquor whose lodgings were over a magazine of brandy with only a loose floor beneath him. In a short time he exhibited all the signs of drunkenness. A few months later he had all the symptoms of general paralysis on account of the vapor of the brandy which worked into his

room. A cure followed on getting new lodgings, whereas his case would have defied all remedies had he remained where he was.

It is generally known that persons, beginning the work of bottling spirits, become readily intoxicated by the fumes. Dr. Marcet makes particular mention of this fact in his work on "Chronic Alcoholism," and calls attention to the circumstance that such persons as are very constantly in alcoholized air, such as barmen, almost certainly take to drinking.

In this way the alcoholic habit has been acquired ere the cup is put to the lips, so that some who at first had strong opposition to drinking have, unawares, had the drink appetite created, while others have been supposed to have had the desire for strong drink born with them. Thus is nature charged with doing what avoidable circumstances have done. Such persons were literally "led by the nose." They took the train on the "Black Valley Railroad," not at "Sippington," as has been commonly supposed, but at Sniffington, a station still further up country.

I have recently seen a man who never drank, yet he died from Bright's disease of the kidneys from the fumes of the spirits to which his business exposed him, and which often caused him to stagger. I make no doubt that he was as much under their effects as though he drank. But the diseases caused by alcohol in the blood, though received through inhalation, are deferred for consideration to a later page.

III. ALCOHOL BY THE MOUTH—ITS EFFECTS ON THE MUCOUS MEMBRANE.

The throat is the great viaduct for alcohol, and what happiness, what hopes, what fortunes, what misery have gone down this way by it!

The effects of alcohol on the mucous surfaces vary with the strength, constituents, and quantity of the liquor used and the length of time it is applied.

Weak liquors more especially modify the taste and, through complex reflex action, increase secretion. It is in this respect that the ingredients of spirits play their most important rôle, so that many kinds of liquors are expressly preferred with reference to their taste and smell. But these *adenda* are no necessary part of alcohol, and hence do not require attention here. Weak alcohol is not, in itself, unpleasant in the mouth. It warms and excites the mucous membrane, and increases the flow of mucus and the salivary secretions—makes the mouth water. In proportion as its strength is increased it burns and irritates, puckers the mucous follicles and dries up the secretions of the immediate parts, while, through reflex action, it excites the flow of tears and other remote secretions, as if nature felt the embarrassment of the suffering part and came in haste with fluids to wash the offender away.

Raw spirits pucker the mouth and instantly paralyze the sense of taste—a fact which is made use of by crafty wholesalers to dupe their verdant customers. This the following will show:

Some years ago a young man opened a country "shop," and came to this city for his stock. The dealer took him into his cellar and showed him a very fine sample of brandy, which he was requested to taste. This was done, but the price being high, another of poorer quality was "sampled," which apparently tasted as well as the first. Thus, down the list they went till one was reached of one-fourth the price of the first, and, to the young man, tasted as well. It was bought as being "as good as the best." A little time only was required to sober both his

tongue and his judgment. This young man was not from "Sniffington," the home of the sharpest purchasers.

Strong alcohol is a fiery irritant to any portion of the mucous surface, excoriating mouth, throat, and stomach. It may set up active inflammation, characterized by friability of the substance of the membrane; by purple spots, extravasations of blood, etc. Thus, the drunkard's stomach is notorious for its softened, injected, and ulcerated condition. So, Dr. Wilson Fox, in his late work on the "Diseases of the Stomach," refers to alcohol as the cause of ulceration. And Leudet, in twenty-six cases of dead drunkards, found ulcers eight times, and calculated that one-third of the whole number of ulcers which he had seen were in persons addicted to the use of alcoholics. He also cites cases of hemorrhage from the stomach from the same cause. A case of duodenal perforation and abscess is cited by Förster. Dr. Geoghegan saw a man who died in eight hours after drinking a pint of spirit, whose stomach was coated with black, bloody extravasations.

Large doses of strong alcohol kill at once, like a blow upon the pit of the stomach. Duplais asserts that swallowing any considerable amount of absolute alcohol is sure death. Orfila mentions a man who died immediately after drinking a stout dose of brandy.

A while since, in this city, an inquest showed that a boy had been killed by a dose of rum. I was myself called to a man who had been abstemious for some time, when he got a good drink of whisky out of a keg by the roadside. The bullet went through him immediately and, literally, like Sisera with the nail through his head, "he bowed, he fell, he lay down; where he bowed there he fell down dead."

Ordinarily, the symptoms of liquor poisoning do not come on so suddenly. Usually, time is allowed for the absorption of at least a portion of the spirit. Then cerebral and other nervous symptoms come to the front and give character to the case.

Potations of weaker liquors, though they excite the larger and more remote secretory glands, do, according to Claude Bernard, actually diminish the flow of the gastric juice, in which respect the alcohol acts the direct opposite of ether.

Alcohol decomposes and precipitates the ptyaline and the pepsine—the active principles of the saliva and gastric juice—and so renders them inert and useless. Hence, the frequent indigestions and dyspepsias of intemperate drinking.

Moreover, it coagulates the soluble albumen on the coats of the stomach which, taken in connection with its contraction of the capillaries and corrugation of the stomach tissues, greatly hinders its own absorption into the blood. Dr. Marvaud supports this statement. We called attention to the hindering effects in this direction of the astringency of the red wines. These are factors also in the frequent vomitings after free indulgence. This retention of the liquor in the stomach, though hard for the stomach, is fortunate for the rest of the system. This also explains why acorns and other astringents taken with liquor retain it in the stomach and so save from intoxication; the liquor does not so readily "fly to the brain."

III. Effects of Alcohol on the Contents of the Stomach and on the Functions of Digestion.

The tree, through its rootlets and leaves, is kept in constant contact with its food, which exists in the soil and air. So also the tissues of the bird, beast, and man are kept in constant relation with their

nourishment, which is brought to them through their rootlets, or absorbing points in the mucous membrane, which dip down into the soil, or contents of the alimentary canal. Thus, in the main, do the spongioles of the plant and the villi of the animal perform the same work, only the former go outward into a surrounding medium, so that, in the nature of things, the plant has to remain stationary, while the latter turn within, and hence allow the animal to change places without being "plucked up by the roots." Unlike the tree it can take up its soil and carry it about with it. In either case the soil must be kept moist or the absorbents cannot do their work. But who, outside of the mad-house, would for a moment think of watering plants with alcohol rather than with the "dew of heaven?" It need not be tried to know what the effects would be. Why, then, water the rootlets of the body with it?

The stomach serves the double purpose of storing and preserving food, and of digesting it. It may have been a question with some, Why is it that substances can be taken into the stomach and not ferment, which would change in one-fourth the time in an equally warm place outside of the body? The answer is found in the fact that it is the *first office* of gastric juice, when in normal quantity and quality, to prevent fermentation. But alcohol, while it is itself antiseptic, lessens the formation of the gastric juice and attacks and decomposes that which does form. Hence, sourness of the stomach, fulness, eructations, and vomitings so common in drinkers.

But the stomach is more than a receptacle for store age and preservation: it is an important digestive organ, especially of certain kinds of food, though it allows all other kinds to pass through it to be acted on further down. Its function in this respect is so

important that it has been well said that "when the stomach goes well all else goes well," and that when it goes wrong all else goes wrong. Whatever, therefore, aids and encourages its work is a blessing, and whatever hinders or deranges it is an evil.

But, in order to get a clear idea of the influence of alcohol on digestion, it is necessary to start with clear ideas of this function itself. And a few statements here in reference to it will greatly simplify what at first appears complex and obscure.

POINTS IN THE FUNCTIONS OF DIGESTION.

1. The countless substances consumed as food are naturally divided into those which nourish and those which do not. The former undergo certain changes, and are taken up into the circulation and carried to the tissues, while the latter go along the alimentary tract as stimulants to the secretions and promoters of the muscular movement of the bowels, so important to the maintenance of good health.

2. The nutritious or digestible kinds are again divided into:

(1) The *albuminoid* or nitrogonous substances, such as albumen, fibrine, casein, legumine, etc., which are converted by the action of the stomach into *albuminose*—a substance like albumen—into which they must all be changed before they can be absorbed and carried into the circulation.

(2) The *saccharine* or all those substances, as sugars, starch, etc., capable of undergoing the glucosic or glycogenic change. They make the bulk of our food which passes along through the stomach almost wholly unchanged to be acted on in the portion of bowel below, where they are readily transformed into the absorbable glucose, and as such taken up.

(3) The *oily* or all kinds of fat. These also pass,

unchanged, further on till they meet with the pancreatic juice, where the oil globules are broken up and converted into an emulsion, having a milky appearance, and hence called chyle. This substance is then taken up by the lacteals—a special system for absorption below the stomach, but which does not exist in the stomach—while the albuminose and the glucose are taken up by the capillaries of the villi which stud the mucous membrane of the stomach and of the bowels below. This gives us a thought worthy of consideration, viz.: that though alcohol will cut up oil in the stomach or before it enters the stomach, there is no proof that it forwards its digestion, since, if cut up, the oily emulsion cannot be taken up into the circulation till it gets some distance below the stomach, by which time the alcohol is mostly absorbed, leaving the oil globules to return to the condition in which they were before for the action of the pancreatic juice.

Returning now to the stomach, we find in it great variety of substances, only a few of which can by any possibility be digested in it. The great proportion of them can, however, be further diluted and separated from their albuminous associations. The few elements the stomach can digest, of which the chief are albumen, fibrine, and casein, whatever be their source, depend for their transformation upon the pepsin of the gastric juice, and will be more particularly studied by and by as the *nitrogenous* compounds.

That alcohol cannot aid the peculiar changes of stomach digestion is certain, while the assumption that it will do so lies squarely in the face of scientific facts. But our object being to show rather than dogmatize, we offer the following to make the above assertion good:

1. *Chemical Facts.*—Alcohol coagulates both albumen and fibrine, converting them into a solid sub-

stance, and throws them down from their solution, thus thwarting the action of the gastric juice. In a solid state they cannot be absorbed.

Alcohol, as we have seen, diminishes the secretion of the gastric juice, unless it is given in so small quantities as not to be appreciated, and kills and precipitates its active principle. Hence, any considerable quantity of alcohol must for the time suspend the function of digestion.

2. *Facts from Experiments with Artificial Gastric Juice.*—Dr. Henry Munroe, of Hull, England, performed many experiments with gastric juice artificially made. Three of them, reported in the *British Medical Journal* (December 9, 1865) are pertinent to our purpose.

Experiment 1. — "Four ounces of gastric juice having been poured into a wide-mouthed phial, half an ounce of raw beef, cut up in small, irregular pieces, was then introduced. The phial was placed for ten hours in a sand-bath at the heat of 100° F., being every two hours briskly shaken to imitate the motions of the stomach. After the first two hours, the fluid became opaque and cloudy, the surfaces of the bits of beef assuming a milky-white appearance. In about four hours, the muscular fibres of the beef on the surface, and at the angles especially, began to separate and loosen. In about six hours the pieces of beef were much lessened in size, and the fluid presented a more cloudy appearance, like broth. In about eight hours, from the shaking of the phial, the pieces of beef were easily broken into shreds of muscular fibre, floating about in the fluid. In about ten hours, these muscular fibres became softened down and were no longer discernible, having become completely dissolved, the mixture presenting all the characters of soup."

Experiment 2.—Having prepared another phial in the same way, he added two drachms of alcohol of 84 per cent. strength. "After two hours, little or no alteration had taked place in the fluid, which seemed to have no action on the beef. In four hours, the fluid was slightly opaque, the beef remaining the same in appearance. In six hours, a slight albuminous coating was seen on the surface of the beef. After eight hours, there was no change to the sight; but the pieces of beef felt more solid during the operation of shaking the bottle. In ten hours, there appeared only the slightest change upon the surface of the beef, the substance of it not having been acted upon at all. On the phial having been set aside to cool, there was seen at the bottom of it a deposit of pepsin, which was not observed at the beginning of the experiment, and which did not appear at the bottom of the phial used in Experiment No. 1."

Experiment 3.—Preparing his gastric juice with Allsopp's bitter ale instead of water and proceeding as before: "In two hours, there was little or no change in the fluid or beef. In four hours, the fluid was rendered slightly cloudy, and the surfaces of the beef slightly coated with albumen. In six hours, the muscular fibres of the beef seemed somewhat separating and loosened. In eight hours, no further change had taken place. In ten hours, the beef presented a similar appearance to the beef in the phial containing alcohol—very little acted upon by the gastric juice. The phial on being set aside, and cooling, a deposit of pepsin appeared, as in the preceding experiment."

These experiments, it will be seen, required more time than is required by natural digestion, but scarcely more than would be required with natural gastric juice outside the body. In the first place, the fluids

in natural digestion undergo constant agitation; and in the second place, the albuminose is absorbed while it is being formed, so that the digestive fluid does not become saturated with it, as is the case outside the body.

In view of these and other experiments which Dr. Munroe made, he concludes: "That alcohol, even in a diluted form, has the peculiar power of interfering with the ordinary process of digestion." Such also is the testimony of others.

3. *Facts from Experiments with Natural Gastric Juice.*—Dr. Figg, of Edinburgh, fed two similar dogs with pieces of roast mutton at the same time, and then to one he gave an ounce and a half of spirit. Three hours afterwards he killed both dogs. The sober dog had entirely digested his meal, while the one which took the spirit had not digested his at all.

More recently, M. Leven gave a dog two hundred grammes of boiled meat with seventy-five grammes of brandy. When the dog was killed, five hours later, the two hundred grammes of meat were almost wholly unchanged, and the stomach was red. Prof. Paul Bert ascertained that even small doses of spirit delayed digestion for the first two hours till absorption of the liquor had been mostly effected.

When Dr. Beaumont was experimenting on Alexis St. Martin, who had a valvular opening into his stomach allowing of an examination of the interior at any time, he gave him a good wholesome dinner, the digestion of which was going on in regular order. He then gave him a glass of gin, when the digestive process was at once arrested, and did not begin again till after the absorption of the spirit, after which it was slowly renewed and tardily finished. This Dr. Beaumont saw inside.

4. *Facts from Individual Experience.* — Almost everybody is familiar with the liability of persons to

fulness of stomach, to nausea and vomiting, following free drinking after meals. Various physicians have cited cases where food has laid for a long time undigested in the stomachs of hard drinkers, and in the stomachs of persons who, though not used to drinking, have at times indulged the social glass.

Dr. Figg tells of some laborers who were paid for their week's work just after they had dined. Upon this they drank, and ate nothing more for twenty-four hours, when feeling sick at the stomach and having a bad headache, the Doctor was sent for. He gave them an emetic, which produced the dinners taken twenty-six hours before.

Gluzinski has recently made very conclusive experiments on the effects of alcohol digestion. He practised with a syphon, drawing off the contents at various times with and without liquor. The conclusions he reached is that alcohol entirely suspended the transformation of food while it stayed in the stomach. After the absorption of the alcohol the acid digestion sprang up and went on at a fair rate, except in cases where there was disease.

"Many years ago," writes Dr. Monroe, "after I had been an abstainer from all alcoholic drinks for six months, I partook of half a pint of Allsopp's bitter ale at dinner. In less than an hour afterwards I felt tired, exhausted in body and mind, inactive, rather feverish, and inclined to sleep, with increased fulness at the pit of the stomach, such as I had not experienced during my term of alcoholic abstinence. This fulness at the stomach, accompanied with slight difficulty of breathing, from pressure on the diaphragm, did not abate for three or four hours after taking the meal; nor did I again feel hungry that day, although I took my usual amount of exercise. For four days I continued to take the ale at dinner,

but always experienced afterwards the same fulness at the pit of the stomach, and other symptoms of arrested digestion. At the end of the fifth day, happily for me, a fit of the gout supervening caused my experiment to be suspended, and negatived the idea that Allsopp's bitter ale was, in any way, a promoter of digestion. After a similar abstinence, I partook, daily, of half an ounce of spirits of wine, diluted with three ounces of water, at dinner. I again experienced the same feelings of distress at the pit of the stomach, inactivity, sleepiness, etc., arising, I have no doubt, from suspended digestion."

Dr. Munroe found the same effects also from wine, and again from ale and change of food; but gout would come, to his own mind clearly due to the alcoholic beverages. "But for some years," says he, "under total and persistent abstinence, I have never suffered from any symptoms of imperfect digestion, and my old enemy—the gout—has entirely retreated."

Perhaps this is the place for me to say that gout is preëminently a disease only of a liquor-using people. The abstemious are mostly free from it. Who ever heard of gout among the aborigines of this country? The Mohammedans, by their religion or other cause, are mostly kept from drinking, and to them this disease of wine and luxury is comparatively unknown.

So, in the same line of thought, Dr. Gallard, of France, remarking on the injurious effects of alcohol on the stomach, says: "No class of society are free from the vicious taint of alcoholism, and a large number of unexplained diseases are probably due to the pernicious habit of drinking or an indulgence in what are called stimulants."

In this view, a French savant—Villermé—denounces the use of wine, with its ultimate effects, as "the greatest curse to the laboring classes of France."

I am sure I can safely rest the evidence here against "a little wine," a little beer, or a little of any other alcoholic beverage, taken "for the stomach's sake;" for the facts of science conclusively show that alcoholic agents are not a help to digestion, but a positive hindrance and an evil. Though the effects of inappreciable doses cannot be proved to be either good or bad, "in larger amount," says Dr. E. A. Parkes, in his "Manual of Practical Hygiene," "it checks digestion, reddens the mucous membrane, and produces the chronic catarrhal condition of Wilson Fox, viz.: increase of the connective tissue between the glands; fatty and cystic degeneration of the contents of the glands, and, finally, more or less atrophy and disappearance of these parts." Thus is the position of Dr. Monroe sustained when he concludes that "the only influence of alcohol on the stomach is that of an irritant." Says Dr. Richardson: "It is an entirely false idea that alcohol acts to aid digestion." It lessens appetite when freely and habitually taken.

ACTION OF ALCOHOL ON THE BOWELS BELOW THE STOMACH—CHOLERA, YELLOW FEVER.

The effects of alcohol on the middle and lower portions of the alimentary canal have not been so generally studied.

We do know, however, that alcohol readily throws down starch, which is one of the most important substances from its solutions. There is reason, then, to suppose that it hinders the passage of such substances forward into the duodenum, by keeping them in a solid state, and so delays their final conversion into glucose.

Alcohol *precipitates pancreatin*, and so destroys the power of the pancreatic fluid, thereby preventing the prompt transformation of the fats as long as it is

present. The larger part of alcohol is, probably, generally absorbed before it gets so far below the stomach. Nevertheless, the experiments of Tidemann and Gmalin, and of Bouley show its presence in the small intestines, while Küss, of Strasbourg, and Marvaud, of Paris, think that it rapidly goes through the door of the stomach, which is always open to fluids. But this will be more or less modified by the amount and kinds of food taken with the liquor.

After large doses of spirit, the irritant, inflammatory effects show themselves below the stomach as well as in it. Examinations after death discover evidences of its disorganizing effects for a great distance. Dr. Christison mentions a case where the whole lining coat of the stomach was in a gangrenous state, and the large and small intestines were red or inflamed their whole length. Dr. Jacobi confirms these observations.

Dr. Palmer, of Batavia, saw many small ulcers in the intestines of a person who had been an habitual drinker, one of which penetrated through the coats and produced fatal inflammation.

Prof. Uffelmann says: "The free use of such dilute alcoholics, even as Tokay wine, has not infrequently produced intense hyperæmia and ecchymosis, as has been proved, of the gastric mucous membrane, particularly of children; which should serve as a sufficient warning." In dysentery they act most injuriously, as experience proves, by aggravating the tenesmus or griping.

But there is a practical demonstration of the irritating action of alcohol on the alimentary track, in the indigestions, the dyspepsias, and the diarrheas of persons addicted to drink. A remarkable proof of its pernicious effects on the intestinal tract lies in its relation to that fell destroyer,

Cholera.

Whether this destructive disease arises from a microscopic germ—the bacillus—or something else, alcohol is its most potent ally. When this scourge was prevailing in 1832, the London *Morning Herald* put forth this: "Intemperance is a qualification it (the cholera) never overlooks. Often has it passed harmless over a wide population of temperate country people, and poured down, as an overflowing scourge, upon the drunkards of some distant town."

The testimony of Dr. Mackintosh, of the extensive cholera hospital in Edinburgh, is this: "Drunkards were the persons generally attacked; and, above all, the first victims are the dissipated, particularly those addicted to the use of ardent spirits."

"The disease," says Dr. Bronson, who treated it in Montreal, "has searched out the haunt of the drunkard, and has seldom left it without bearing away its victim. Even *moderate drinkers* have been but little better off." Under the false idea that spirit is a preventive of disease, and especially of the cholera, many persons rushed for the bottle, "but," says Bronson, "they did it at their peril." It is stated, that out of 1000 deaths in that city, only two were members of temperance societies. During this same time there were 5000 members of temperance societies in the city of Albany, and Dr. Mussey assures us only two of them fell by the disease. There were 204 cases in Park Hospital, in New York, and Dr. Sewall, who came from Washington on a visit, made inquiry and reported that only six of them were temperance men, and they all recovered. On account of this scourge, the grog-shops were closed, as a nuisance to public health.

In 1853, 900 persons died in Rotterdam, and only three were total abstainers.

In Tifflis, in Asiatic Russia, a city of 20,000 inhabitants, Mr. Huber reported "every drunkard has fallen; all are dead; not one remains."

In the town of Warsaw, Poland, a physician states that all who lived in healthful localities and did not drink were spared, while those who were broken down by excess and dissipation were invariably attacked. What I have stated of cholera is equally true of that twin scourge,

The "Black Vomit," or Yellow Fever.

Whatever doctors may yet determine to be its "true inwardness," it remains that alcohol remarkably disposes towards it, and mightily aids it when it comes. At one time this scourge fell upon Key West, and Judge Cranch is authority for saying that those who died of it were in every case addicted to the habitual use of ardent spirits; and this fact coming to light, there was a speedy decrease of the quantity of liquor drunk, and the inhabitants as speedily becoming rid of the scourge.

Dr. James Rush, who was witness to a fearful outbreak of this plague in Philadelphia, said: "Every species of inflammatory and putrid fever is rendered more frequent and dangerous by the use of spirituous liquors. This has been remarked in all the yellow fevers which have visited the United States. Hard drinkers seldom escape, and rarely recover." Thus writes Dr. G. Dowell, of Texas, in 1876, and he had very large opportunities for observation: "All habitual drinkers died. None recovered who were taken while drunk." In New Orleans 5000 died of the disease ere one sober man was touched.

Without multiplying facts further on this point, we may say that, while outward cleanliness will do much to ward off an outbreak of yellow fever,

and clean streets will do more—as General B. F. Butler proved in New Orleans—the best preventive against either of these great scourges is a *clean stomach.*

Chronic diarrhea, with destruction of many of the muciparous follicles, and thickened or ulcerated state of different portions of the lining membrane of the smaller bowels also goes to show the harmful action of alcohol on the alimentary canal.

IV. WHAT BECOMES OF ALCOHOL IN THE STOMACH?

Some of it remains with the waste, and so passes on and out of the body; but most of it passes into the circulation, where its presence is everywhere speedily shown. Such observers as Bouchardat and Sandras, Longet, Lallemand, Perrin, and Duroy suppose that this absorption takes place chiefly and directly from the stomach; though some, as we have seen, think that it is mostly absorbed from the smaller bowels. No doubt its fiery action on the stomach, especially when there is little food in it, frequentiy causes the spirit to be thrown rapidly forward into the bowels, where, again, its irritant effects manifest themselves by looseness or diarrhea. Very many substances, however, impede the absorption of alcohol, causing it to remain in the alimentary canal much longer than it otherwise would. These substances are acids, tannin, sugar, mucilaginous preparations, and especially fats. Thus, certain English people are accustomed to drink fat broth or take a glass of oil to prevent its intoxicating effects. The alcohol in the so-common prescription of "cod-liver oil and whisky" is doubtless modified in the same way.

There are but two ways by which fluids can be taken up from the alimentary canal: 1, by the minute bloodvessels, or capillaries of the mucous surfaces;

2, by the lacteals, or chyle-vessels, which begin to show themselves in the bowel below the stomach, in the region where the chyle is formed.

That alcohol is absorbed by the capillaries, Magendie, Tiedemann, and Gmelin have demonstrated. Bouchardat and Sandras experimented on many different animals to find it in the contents of the chyle-vessels, but without success.

But since alcohol has attraction for all watery fluids, the great physiologist Longet, to whom we may add Marvaud, thinks that it must exist in the chyle, although in too small amount to be traced. *But is not a portion of the alcohol in any way digested or transformed before it is taken up?* This is one of the most important questions in this whole study, but as yet without any direct proof that it ever is changed before absorption. That it is *not* transformed the following seems to show:

1. The fact that so much of it is taken up without any change, as is acknowledged on all hands, offers a good reason for supposing that it may all be so taken up unless it can be positively shown that some of it is digested, which has never been done. A portion of the amount ingested does, indeed, remain in the bowels in connection with the waste, and with it thrown off, being detected as alcohol in the feces.

2. The line of changes which we have elsewhere seen it must undergo, if it changes at all, is that of oxidation, either at once or by degrees, into aldehyde and vinegar. If it oxidizes at once, or, in other words, is burnt up, as some authors have supposed, it, of course, passes at once into its products—carbonic acid and water, the former of which is of no good to the body, and ought to increase the amount of carbonic acid exhaled, which it does not do. If so burnt it must create a great amount of heat, the

same as though burnt out of the body, which is contrary to fact, since it depresses instead of raising the bodily temperature. If the alcohol oxidizes by degrees it must form in order aldehyde and acetic acid. Now, these changes take place slowly, and not by virtue of decomposing albuminous substances with which the alcohol comes in contact, but by the action of certain well-known germs—the *mycoderma aceti*—which, coming to the surface of the liquid undergoing acetic fermentation, take oxygen from the air and give it to the alcohol. Hence, this transformation requires time, which the circumstances do not allow. Moreover, the products of such a transformation are not found in the stomach, nor in the blood, into which we must suppose them to have been absorbed. But the sour eructations and vomits of the liquor-drinker, like the acids of other indigestions, are the lactic, the propylic, the butyric, and rarely the acetic.

3. Again, if the gastric juice, which is the transforming agent of the stomach, sets upon alcohol to digest it, the alcohol is found to be the stronger of the two, and the fact, illustrated by the rat gnawing the file, exactly takes place—it is itself acted on—its pepsin is destroyed—in short, its teeth are filed off. Dr. Thomas Sewell, of Columbia College, states: "There are substances upon which the gastric juice has no action, or, if any, it has not the power of converting them into nutriment; and alcohol is one of them."

V. Alcohol and the Blood.

The presence of alcohol in the blood, and that in an unchanged state, after it has been taken into the stomach, has been abundantly shown by Magendie, Ségalas, Bouchardat, and Sandras, Lallemand, Perrin

and Duroy, and others, who have experimented both on animals and man. And not only is alcohol found in the blood unchanged, but it is so for many hours after its ingestion. Dr. Maurice Perrin found it six hours and nine hours still presenting all its original characteristics. Dr. Percy found it as late as thirty-six hours in rabbits. Others have found it later still. The effects which alcohol has on the blood may be shown in several ways.

I. ACTION OF ALCOHOL ON FRESHLY-DRAWN BLOOD.

When alcohol is added, according to Schultz, the blood turns dark, owing to a portion of the coloring matter of the blood globules being dissolved out and mixing with the watery portions. The blood undergoes coagulation. MM. Monneret and Fleury, trying the experiment, witnessed the change in the color. They had mixed equal parts of alcohol and blood from a vein, but it did not form a clot, as in Schultz's experiments. L. Lallemand, Perrin, and Duroy took up the experiment and ascertained that it was the degree of concentration of the alcohol which determines the coagulation; for, while 20 parts of alcohol of 28 per cent. strength would at once coagulate 60 parts of blood, 21 per cent. alcohol would form only a light clot, and 16 per cent. alcohol would form no clot at all. Dr. Marvaud also demonstrated the same facts. ("L'Alcool son action Physiologique.")

II. BY INJECTING ALCOHOL INTO THE VEINS OF LIVING ANIMALS AND SUBSEQUENTLY KILLING THEM.

In making these experiments Magendie showed that a mixture of half brandy and half water, which would give not far from 25 per cent. alcohol, when injected into the vein of a dog's neck would appear to do no particular harm; while stronger injections

proved rapidly fatal in the hands of Royer-Collard. Orfila noticed that injections of this kind acted differently on the two sides of the heart. There were clots in the venous or right side of the heart, while the blood remained fluid and red in the arterial side. This difference is evidently owing to the fact that the animal does not die at once. The blood on the right side of the heart is that which has most directly received the effects of the injection. That on the left side has had to go through the lungs to get there; so that its clots have been strained out in the right side of the heart, and afterwards it has received the oxygen of the lungs.

III. THE MORE COMMON TIME FOR STUDYING THE EFFECTS OF ALCOHOL IS AFTER IT HAS BEEN INTRODUCED INTO THE CIRCULATION THROUGH THE STOMACH.

The blood of persons who have died after being under the influence of liquor for a time, has been observed to be black and to be remarkably fluid in its character, as is the case with persons dead from suffocation or asphyxia.

Magnus, Hüss, and others have also pointed out the fact that the blood of hard drinkers is remarkably full of the globules of fat. That this oily state of the blood is due to the effects of alcohol may be easily proved on the lower animals by causing them to drink or take alcohol in their food for a time and then examining the blood under the microscope. This fact stands in the way of those who would attribute the fat-producing effect, so often noticed in persons who indulge in alcoholic beverages, to other qualities of the beverages than to the alcohol itself.

It is an interesting question to ask, but a difficult

one to answer in the present state of our knowledge: *Whence come these oil globules?* Now, it is certain that they cannot come from the alcohol itself. It is no more likely that alcohol has dissolved down any previously-existing portions of fatty tissues. It is, therefore, altogether likely that their existence is a result of *hindered nutrition;* and the following has some grounds for being the correct explanation: The fatty substances which we saw digesting by the action of the pancreatic juice had their globules broken up by the juice much smaller than they were, thus forming a kind of emulsion—the chyle. This liquid is taken up by the system of lacteals and carried into a main channel—the thoracic duct—along which it is conveyed till it is emptied into a large vein on the left side of the neck. If this fluid be examined in the thoracic duct the minute oil globules—the chyle globules—will be seen. After they have entered the vein they may still be traced. As they go onward and meet with successive changes some have supposed that they come round in the end to be the blood globules. Be this as it may, it is not far-fetched to believe that, as the presence of alcohol is capable of breaking down and destroying blood globules already formed, it is equally capable of aborting the changes going on to form new ones, or even of degrading tissues, so as to produce them, oil being a product of tissue degeneration. Hence, we may not be surprised to find the presence of abundant oil globules in the blood of alcoholized men and animals, whatever may be their true source. Furthermore, we shall see that the blood globules cannot do their work in the exchange of the gases in the presence of alcohol.

Taking the above, together with the known hindering effect of alcohol over the removal of the carbonic

acid by the lungs, we have something of a rational basis for accounting for the tendency to obesity so common among habitual drinkers; for the blood, being no longer able to endure the burden of fatty elements with which it is loaded, throws them out into the different tissues. Hence the bloating of the body and the fatty infiltration of the tissues in general. Indeed, so remarkable is the alteration of the skin thus brought about that its peculiar velvety feel is diagnostic of the potatory habit. It was in this way that Prof. Neumann, of Vienna, often pronounced upon the habits of his patients when otherwise they were not likely to be suspected of such indulgence.

The above view has countenance from still another fact, viz.: that during the fattening process the body fails of its due amount of vital nourishment, as is shown by the increase of both nervous and muscular weakness. Lord Chesterfield regarded fat and stupidity as convertible terms, and Shakespeare doubtless had in view the same idea when he coined the term, "fat-witted." "Fat-headed" was a term of Horace, two thousand years before.

IV. ALCOHOL AND THE GLOBULES OF THE BLOOD.

What the physiologist calls a blood globule, or blood corpuscle, is a small semisolid body floating in the liquid part of the blood and made up of a principal substance contained in a cell or sac, in the midst of which is a coloring-matter, which gives the color to the globules, and through the globules, to the blood. This inner substance, or coloring-matter, is mostly composed of iron, and is regarded the chief agent in absorbing oxygen in the lungs and of giving it out again to the tissues; and also in taking up carbonic acid and conveying it to the lungs. When

loaded with oxygen they characterize the arterial or red blood, and when charged with carbonic acid, the venous or dark blood. They constitute one-half of the bulk of the blood. The eminent physiologist, Dr. John C. Dalton, Jr., of New York, teaches that the oxygen and carbonic acid of the blood are held in solution mainly in the blood globules, and not in the serous fluid in which the globules float. And the researches of Dr. Magnus show that the blood holds in solution two-and-one-half times as much oxygen as it is possible for pure water at the same temperature to dissolve, while the serum of the blood can dissolve no more than pure water. These two facts decidedly prove that the power of dissolving and retaining oxygen inheres in the globules. The same is true as regards carbonic acid. Alcohol at first increases then diminishes the movements of the white blood cells.

In reference to the foregoing statements, Dr. Dalton observes: "It is, therefore, the semifluid blood globules which retain these two gases in solution; and since the color of the blood depends entirely upon that of the globules, it is easy to understand why the blood should alter its hue from purple to scarlet, in passing through the lungs, where the globules give up carbonic acid and absorb a fresh quantity of oxygen."

Dr. Dalton further says: "In this double phenomenon of exhalation and absorption, which takes place in the lungs, both parts of the process are necessary to life."

The tissues require to be steadily supplied with oxygen by the blood; and if this be cut off, their functional activity ends. On the contrary, the carbonic acid produced in the body by the processes of nutrition becomes poisonous in large quantities.

Ordinarily, the carbonic acid is removed by the lungs as fast as it is produced in the tissues; but if respiration be suspended, or seriously impeded, since the production of carbonic acid must continue, though its elimination be prevented, it accumulates in the body, and terminates life in a few minutes by a rapid deterioration of the circulating fluid, and by its poisonous effects on the nervous system.

The foregoing offers a clear statement of the physiology of the blood, where every idea forms a standpoint from which we may judge of the perverting effects of alcohol on the physiology of this fluid, and through it on the body at large.

Now, alcohol, when mixed with the bright arterial blood, at once turns it dark, like venous blood, thus acting the part of air loaded with carbonic acid. If a quantity of blood be brought into the field of a microscope, and alcohol be put with it, the globules shrink and pour out a portion of their red contents, while many of them break up altogether and mingle with the surrounding serum.

But these little globules, or gas-carriers, are very sensitive and the most useful and necessary element of the blood, being unceasing in their activities in carrying on the work of clearing out waste materials and supplying the tissues with the vitalizing oxygen; and, though usually travelling the circuit of the system at a rapid pace, they never go empty-handed, and never rest day or night. Their work is a vital work. Hence, whatever interferes with them, so as to cripple their function, strikes an essential point to the welfare of the body.

Now, alcohol utterly breaks down some of these useful bodies; it shrinks all the rest as it shrank the kitten's bladder, and causes the escape of a portion of their contents, and, entering into them, takes

possession of them, where, like the dog in the manger, it neither does their work nor suffers them to do it. Thus, aside from the destruction of the globules, which is at once an actual loss, and which is so manifest in the weakness and haggard paleness common among the spirit-drinkers, alcohol in the blood, and just in proportion to its amount there, obstructs the office of the blood at both ends of the route: it refuses oxygen in the lungs; it refuses the accumulating carbonic acid in the tissues. To put a rope about the neck, and, at the same time, to inject carbonic acid into the veins, would be doing just about what alcohol accomplishes through its action on the blood globules in obstructing their vitalizing and purifying functions.

Such statements as these will enable us to see how very baseless is the prevalent notion, even among many of our best physicians, that alcohol is useful to the body in the direction of the

V. CONSERVATION OF TISSUE.

The belief that the use of this agent actually arrests tissue waste, and so conserves the vital powers, is so generally accepted, and withal so very flattering, that it has become the foremost argument to-day for prescribing spirituous drinks, especially where little food can be given and there is great prostration coming on in the course of severe and long-continued diseases.

Now, the fallacy of this argument lies just here—*in the assumption that the elimination of carbonic acid by the lungs is equivalent to the death in the interior of the tissues;* that is to say, that, as carbonic acid represents tissue death and the oxidation of the dead particles, the decrease in the discharge of those oxidized particles is proof positive that they do not die,

but remain alive. Thus, as an alcoholized man does not exhale as much carbonic acid as when there is no alcohol in him, therefore, the alcohol conserves his tissues in a living state. What other conservation can there be?

A little clear thinking here is all one needs to see that the death of the elements of the body, and their oxidation and removal, are entirely distinct and separate processes. Of course, if there is no death there is no waste to be thrown off. On the other hand, there may be waste in the interior, and yet, by a suspension of those functions by which it is removed, no waste appear in the breath.

Supposing I wind a cord tightly around my finger and check the circulation, the finger is not killed at once, but the tissual change goes on, as is apparent in the color, from waste matter which cannot escape. A man with a rope about his neck does not die immediately, though his whole body becomes dark, like the finger, for want of the respiration which should supply oxygen and carry the waste out. The heart beats, the tissual changes go on until they kill the man from within. Were it not so, a man with a rope about his neck would die scarcely any sooner than if it were under his arms, where the negro wished it put in his case, as he said he was "very ticklish in the region of the neck."

A like course of things occurs in asphyxiated persons from drowning, breathing carbonic acid, and from various forms of strangulation, as from croup, œdema of the glottis, and suffocative catarrh. The links in this chain of events are: deprivation of the air and its oxygen, accumulation of carbonic acid within, failure of nutrition of the tissues, nervous prostration, heart failure, death.

Now, nobody at this day disputes that, when alcohol

is introduced into the blood, there is a diminution in the amount of carbonic acid exhaled. But there is nothing to show that this decrease is owing to a cessation or diminution of waste within. On the contrary, the color of the skin, the weakness, the copious escape of the products of molecular death after the alcohol has been removed, etc., all show that tissual waste had been going on and was in no wise hindered by the alcohol, only so far as it did not allow the proper supply of oxygen to convert the waste into carbonic acid and promote its removal.

Molecular death in living beings is balanced with molecular life, and just as long as I live I must continue to die whether the products of that death are immediately apparent or not. In our great cities there are usually undertakers enough to remove the bodies of those who die, yet these cities would become pestilential with stench if the undertakers should all "go on a bender" as the blood globules do when any considerable alcohol is taken into the body. How foolish would I be to drug the undertakers and, because I afterwards found fewer bodies going into the cemetery, conclude I had conserved the health of the community? Neither drunken men nor drunken blood globules can do their proper work.

The reasoning for this assumption of the conservation of tissue is about like this: "I put a dam across a brook, and I see there is less water in the channel below; therefore, I have stopped up the fountain." Take away the obstruction and the accumulated waters rush onward to make up for their delay. Just so all observers notice that there is an unusual elimination of waste products after the alcohol has passed off. And to our mind, the whole case turns simply upon the modification of the functions of the

blood globules by the presence of the alcohol acting on them, and not on the conservation of tissue at all. Now, it is impossible for us to believe that the retention of already dead products is an advantage to the body, or that the admission of pure air is to result in the destruction of tissue which is not already dead. Good blood is life-giving—not destructive. It is like the oil upon the gudgeons to save friction and not to create it, and to remove that which is already worn out. To conserve the wear of an engine we must put out the fire; to conserve our tissues is to die, or to retire from physical activities, like Dr. Jewett's toad growed up in a tree.

What would the advocates of the conservative effects of alcohol say if another class of physicians should rise up and begin the practice of tying cords around the necks of their sick patients (to say nothing of this practice on the well) to lessen the excretion of carbonic acid from their lungs in order to save strength, and the weaker the patient the tighter to tie the cord? Would not such a course be weakening rather than strengthening? Surely, they would say, "Do not do that;" and yet these facts of the physiological action of alcohol on the blood show that alcohol in the blood and a cord about the neck produce precisely the same results; and the one can no more conserve the tissues than the other. If so, a man partly dead must be supposed to be in a condition to live longer than if he had full flow of life in his veins. But more than this. Every physician of any considerable practice has time and again observed how weak persons speedily become with slight affections about the throat interfering with respiration. The same amount of disease elsewhere would hardly attract notice, but, by reason of its obstruction to respiration, the blood is not aërated, and conse-

quently it cannot perform its functions, and prostration of strength rapidly ensues.

The truth of the whole thing is: A lessening of the functions of the blood globules is a lowering of the vital forces; fullest vigor is possible only in the presence of the purest blood. Retention of effete products in the body is so far inward uncleanness—disease, fever. If outward "cleanliness is next to godliness," what physiological virtue must there be in pure blood?

Every one knows how strong and disagreeable is the odor from the bodies of free drinkers. The waste materials which, in a normal state of the system, would have been oxidized and thrown off imperceptibly, have accumulated over and above the power of the blood, crippled as it is, to dispose of them. If the alcohol be left off for a short time, the globules recover their functions and oxidize this mass of putrid matter and throw it out of the system.

During a period of five days, Dr. Wm. A. Hammond states that he took sixty drachms of alcohol with his usual amount of food, and gained .45 of a pound. "In the same period," says he, "the amount of carbonic acid and aqueous vapor exhaled from the lungs had undergone diminution, as had likewise the quantity of urine and its solid constituents." This is the kind of experiment on which he constructs his theory of the "conservation of tissue." But will Dr. Hammond show us that this .45 of a pound was *live tissue* and not the water or effete matters which ought to have been thrown off? And did not his *new flesh* leave like the early dew when the spirit was withdrawn? These are important questions for him to answer before we can accept his conclusions.

There is no more interesting function in physiology than the intercharge of gases which takes place

between the external atmosphere and the remote tissues within the body, through the agency of the blood globules. Considering this, Dr. Marvaud observes: "One can explain how alcohol can check the nutrition and vitality of the blood globules, by causing in their interior a stay and a heaping-up of materials, which have become unfit for their functions, and in checking, at the same time, the attractive and elective power which the globules exert over the useful and restorative matters contained in the serum ("L'Alcool son Action Physiologique").

The numerous experiments of both Graham and Dutrochet clearly demonstrate that the normal osmotic action of the globules is decidedly deranged and obstructed by the presence of alcohol.

In our First Part we noticed the close similarity between the function of the yeast-germ and that of the blood globules, and mentioned the fact that the function of the yeast-cell was entirely suspended by the alcohol when increased to about 17–20 per cent. of the fluid. Now, just how much alcohol the blood will bear without absolute suspension of its physiology we do not know; but considering the fact that a small quantity begins to show a diminution in the excretion of effete products, which increases the more as the doses of alcohol increase, together with the other evidences of the obstructing effects of alcohol on the globules, it is fair to assume that the per cent. cannot be very great. And this assumption has almost a demonstration in the late experiments of the two able physicians, Drs. Dujardin-Beaumetz and Audigé, of France. They made hundreds of experiments on dogs and hogs, proving the different effects, as we have before stated, of the different forms of alcohol. They further demonstrated that, for these animals, one part, to one hundred and twenty parts

of the bodily weight, of pure ethylic alcohol would surely kill within thirty-six hours, while one-half the quantity of potato-spirit or fusel oil would be a speedily fatal dose. Therefore, supposing the same relation exists between alcohol and man, it would require but a little more than a pint of the very purest ethylic spirit, or a little more than a tumblerful of potato-spirit, to kill the man. But as pure ethylic spirit is rarely had, the mixed form being that usually sold at the groggeries, the amount of common liquor to kill must vary from $\frac{1}{240}$ to $\frac{1}{120}$ of the man's body weight. Hence, it is almost demonstrable that persons who have been killed outright by heavy drinks, have been killed, not by nervous shock as commonly supposed, but by a direct arrest of the functions of the blood globules by the presence of the alcohol, just as we may demonstrate its action in at once suppressing the function of the yeast ferment by pouring alcohol into a mixture containing it.

VI. Alcohol Undergoes no Change in the Blood.

The assumption that it is changed lacks proof. Neither chemistry, physiology, nor experience have yet been able to demonstrate it. It is easy to trace alcohol into the blood and to show its presence there, *but no one has ever shown that it undergoes any alteration while in the blood. The known facts are all to the contrary.*

Some physiologists have *supposed* that it takes an atom of the oxygen of the blood and becomes aldehyde, according to the law we have shown, and that it is the aldehyde which causes the intoxication. Others, among whom may be mentioned Bouchardat and Sandras, have *supposed* that it might pass at once into water and carbonic acid, though sometimes

developing aldehyde and acetic acid, the intermediate products, on its way. Thus, the oxidation of alcohol in one way or another seems to have been wellnigh the universal belief among professional men till about 1861, when Lallemand, Perrin, and Duroy, professors in the school of Val-de-Grâce, by a series of deeply interesting experiments exposed the baselessness of this belief. They could not find the products of such oxidation, and, thinking that there might be some unknown conditions which prevented their detection, they made a series of crucial experiments by introducing such substances into the system, which they afterwards found no trouble in detecting To them this was an unequivocal proof that if such products were produced by the oxidation of alcohol in the blood, they could have been detected just as well. More than this; they found alcohol in the various tissues supplied by the blood, and also in the different secretions derived from it. Since, then, as they could not find aldehyde nor acetic acid, nor any of the products of the combustion of alcohol, but could find the alcohol in an unchanged condition, and that for some time they very naturally concluded that it was not changed, but was wholly removed by the various emunctory organs, as alcohol and nothing else.

Thus, as by one stroke, all previous theories as to the disposal of alcohol were turned to naught, and all the hopes of its heat-producing or nourishing qualities, based upon its supposed oxidation, were at once and completely demolished.

But old notions are tenaceous of life, and the astonishing conclusion of the professors of Val-de-Grâce, like the attack made on Fort Sumpter, about the same time, was a general call to arms. Physiologists in every part of the world, but especially in Germany

and France, entered vigorously into the contest; and such an array of painstaking experiments as have been made upon the action and disposal of alcohol in the body, within the last score of years, has never been witnessed before. Maurice, Ludger, and most French physicians accepted their conclusions, and the result has been to completely dislodge it from its principal strongholds, and show that the facts of science as applied to alcohol to-day are not against, but strongly in favor of the principles of total abstinence, since alcohol has no claims for admission into the human organism. It is only a foreigner and an enemy there. The only really strong objection, so far as we have seen, against the conclusions of Lallemand and his learned colleagues is that made by Baudot. Anstie and Dupré made the same. It is based on the ground that alcohol, once administered, cannot all be recovered again, and only a small part of it is known to escape in the excretions, Dupré collecting about 24 per cent. But, since a portion of the alcohol can be found in the excretions and the products of the decomposition of the remainder cannot be found, it begs the question to assume its oxidation, while, on the other hand, it is most natural to believe that it all escapes, as Lallemand and his colleagues supposed.

The experiments of Sulzynski and Maryan, as cited by Godfrin in 1869, go to show that the blood may exert such an influence over it as to cause it to elude the best efforts to detect it. It really requires a much less stretch of the imagination to conceive that a portion of the unchanged alcohol should escape detection, than that the various products into which it must be transformed, if transformed at all, should all escape detection. Hence, we cannot conclude with Marvaud that the greater part of this liquid is

destroyed in the economy, since the last horn of the dilemma has less reason for it than the first. But Dr. Parkes thinks that the criticism of Baudot does not invalidate the conclusion of Lallemand and his associates.

It was a great work which Prof. Liebig did when he divided the nutritious portions of alimentary substances into the two classes of repairers of the tissues, or such as contain nitrogen, and the heat producers or the hydrocarbons, such as the starches, fats, and sugars. It was into this last class that alcohol by its chemical make-up naturally fell; and it was not long before the better part of medical men became satisfied that alcohol could no longer be regarded as a true nourisher of the body, and did not belong here. Then the conclusion of the professors of Val-de-Grâce followed and caused another advance against it, by which its claim to even a respiratory, or heat-producing aliment, is to be denied, thus casting it out of the category of foods altogether.

Two facts seem to confirm this rejection of alcohol from the list of respiratory aliments: diminution of the excretion of carbonic acid, and depression of bodily heat; and both of these facts make against the decomposition of alcohol in the blood.

I. DIMINUTION OF THE AMOUNT OF CARBONIC ACID ELIMINATED BY THE BLOOD.

It may be laid down as a universal rule, *that all true respiratory aliments undergo transformation in the body, resulting in an increase in the excretion of carbonic acid.*

Many years ago, Dr. Prout ascertained the fact that the ingestion of alcoholic liquids was followed, not by an increase, but by a decrease in the exhalation of this acid—a truth which has been demonstrated over

and over again by experimenters in both this and other countries—even very moderate portions of alcohol being attended with marked effects in this direction. But these effects are only temporary, and are followed with increased exhalation after withdrawing the spirit, allowing the globules time to recover their functions.

II. DEPRESSION OF ANIMAL HEAT.

Again, it must be regarded as a universal law that *the combustion of carbonaceous substances within the body engenders heat.*

If alcohol be burned on the outside of the body, it evolves much heat, and if it is oxidized in the body, it must do the same. Now, the researches of Duméril and Demarquay, of Ringer and Rickards, of Dr. Edward Smith and Prof. Perrin, and others, demonstrate beyond a doubt that alcohol, so far from increasing bodily heat, invariably reduces it, and that from a fraction of a degree to several degrees, according to the dose and the time after it has been taken. In 1879, Dr. Binz, of Bonn, related at a meeting of the British Association for the Advancement of Science a number of experiments performed by him, which went to show that an important effect of alcohol upon the human system is to reduce the temperature from three to five degrees. He said that the alleged heat of the body from alcohol does not exist. "I long since," says Liebermeister, "convinced myself by direct experiment that alcohol, even in comparatively large doses, does not elevate temperature in the interior of the body in either well or sick people." ("Ziemssen's Encyclopædia.")

In the *British Medical Journal* (April 4, 1874) is an account of some experiments performed by Dr. Parkes to ascertain this fact, as a fact of science. Three

points were kept in view at once—the effect of alcohol on the temperature, on the pulse, and on the respirations of a man in sound health. And, to get the exact bearings of the case, he compelled his man—a soldier—to take exactly the same amount of food and exercise for several days in succession, noting carefully every feature of the case in reference to these three points. His man finished his breakfast at 7 A.M., and lay in bed till 2 P.M., when he arose and took exercise, and at 9 P.M. he retired for the night. He had no spirit for the first six days; but on the seventh, at 11 A.M., he took one ounce of undiluted brandy, which was equal to half an ounce of alcohol. (It will be noticed that the dose of brandy was not taken till four hours had passed, giving time for the digestion and absorption of his breakfast without any hindrance from the liquor.) On the eighth day he took two ounces of brandy; on the ninth, four; on the tenth and eleventh, six ounces each day.

The result of these experiments showed that the temperature was increased after meals till digestion was accomplished, but in no case did the brandy increase the heat of the body, not even when the six ounces of brandy (600 grains of absolute alcohol) were in it. "This amount of alcohol," says Dr. Anstie, "is capable of generating an enormous amount of force, but it is equally certain that this force does not show itself under the form of heat." On the other hand, however, the amount of reduction was only very slight, which is just as we should have supposed, on Lallemand's theory, under the circumstances; for, if the reduction of temperature be, in a considerable part, due to the insensible evaporation of alcohol from the lungs and skin, the surest way to prevent this reduction would be to check the evaporation, as Dr. Parkes did—by wrapping the man in woollen

blankets and keeping him quiet in bed. The respiration was not changed; and the pulse, which beat somewhat more frequently under the liquor, afterwards fell below its normal standard, so that during the twenty-four hours the number of the pulsations were about the same with the spirit as without it, and could not be increased above that standard unless large and frequent doses were given.

Certainly, this all looks bad for an avowed *stimulant!* We are, therefore, compelled to abandon the idea of the oxidation of alcohol in the body.

Referring to Dr. Anstie again (*The Practitioner*, July, 1874), we find him saying: "Considering the very high theoretical force-value of 600–800 grains of absolute alcohol, if alcohol be indeed oxidized, and yet does not beget force which can be used in the organism, this would be the *strangest possible discovery.*"

The question, then, of the oxidation of alcohol in the body has no scientific proofs for it, but is contrary to all known principles of science, compelling us to believe what would be a physical monstrosity—a miracle, and that without the object of a miracle.

Dr. Anstie (*The Practitioner*, December, 1873) remarked that "the influence of alcohol in reducing temperature is a fact so contrary to preconceived ideas, that until within the last few years it was never suspected."

It was first demonstrated by Lichtenfels and Fröhlich in 1852. And in the late Franco-German war such men as Profs. Binz and Socin, who occupied high medical posts, sought to utilize this newly-discovered principle in the action of alcohol in the treatment of disease, but, so far as we know, without satisfactory results.

It is upon this peculiar action of alcoholic agents in reducing heat that some physicians have attempted to

explain the usefulness of Dr. Todd's great doses of liquor in fevers; while others seem to think that they see in it a most important addition to our means for suppressing those attacks of febrile heat with which every physician so frequently comes in contact. But, be this as it may, we think the above facts prove incontestably that alcohol cannot be intelligently taken as food; that it is not decomposed in the animal organism; and, therefore, it must, after a longer or shorter time, be quite or wholly removed from the system, just as the accomplished French savants have taught.

Accordingly, we are constrained to think that the instances of persons who are said to have subsisted chiefly upon alcohol for a long time, which Dr. Anstie, Dr. Hammond, and others have cited, must be accounted for on some other theory than upon the sustaining and nourishing power of alcohol. What kept Dr. Tanner alive forty days? Still, we freely admit that there may be occasional cases which are outside of the ordinary course of things, and which seem to thrive on what would be detrimental to the well. And it is not, therefore, any more strange that some persons should be apparently benefited by alcohol, than that others should be benefited by opium, arsenic, or any other poison. The fact that a certain article may be used as food or medicine by now and then a person at certain times and under certain circumstances does not argue the general wholesomeness of such a substance any more than a tamping-iron through the head of a New Hampshire man, or a pistol-bullet through the brain of another (as lately reported by Dr. R. F. Baldwin, of Winchester, Va.), argues the safety of tamping-irons and bullets through the heads of the people at large.

Because a certain nervous young woman, whom I knew, lived nearly all summer on little else than

sugar pellets, it was foolishly contended that pellets were highly nourishing, and, therefore, another member of the family, in real need of nourishment, was put upon pellets, and speedily perished.

The fact is, that these instances, supposing them to be true, are outside of the usual course of things, and, therefore, cannot be made to contribute in a scientific way to the establishment of a general law. Hence, they must be taken simply for what they are worth as individual, isolated cases. Alcohol does cripple the blood globules, and through them the vital changes, and, therefore, animal heat is decreased.

VII. Effects of Alcohol on the Circulation.

The organs composing the circulatory apparatus are four — the heart, arteries, capillaries, veins; concerning which a few statements are proper here.

1. *The heart* is the central, strong, muscular, propelling organ, whose cavities measure and whose actions govern the amount of blood sent out by it.

2. *The arteries* are the strong, elastic vessels into which the blood is first sent; which divide and subdivide till they come down to about $\frac{1}{3000}$ of an inch in diameter, or the thickness of the blood globules. Their walls are elastic, that they may suddenly receive the blood from the heart and not rupture, and then contract upon it so as to keep up a continual onward flow while the heart is at rest or refilling for another beat. But they are not simple elastic tubes, for they have nerves—the vasomotor nerves—and so contract or expand according to the general state of the nervous system or the stimulus to any part of it.

3. *The capillaries* form the network of vessels, all of the same size, which lie between the smallest division of the arteries and the veins. They consist

only of the attenuated inner coat of the arteries, and are so small that the blood globules roll along, one after another, through them in contact with their walls, though three hundred and fifty or four hundred times slower than they pass through the principal arteries, thus allowing time for the exchange of gases between the globules and the air or tissues. The gaseous exchange, therefore, takes place here, and not while the blood is passing the larger vessels.

4. *The veins* gather up the blood from the outer end of the capillaries and bring it back to the heart. All along their inner surface are folds, or valves, which prevent a return of the blood upon the capillaries during pressure or muscular action. The veins of the portal system only are an exception to this, for they have no valves; hence, piles, etc., from lifting or hepatic obstructions.

By reflecting a little just here we see the grand provision of nature for the functions of the globules. The attenuated walls, the smallness of the capillaries, their great number allowing for a slow movement of the blood through them, all favor the osmotic action through their walls. Should the air be altered, the globules altered, or the state of the ultimate tissues changed, the functions of the globules will be interfered with, and that in proportion to the extent of the alteration.

It is while the blood is passing through the capillaries, also, that the serum gives out the nutriment which it carries—so well explained by Dr. Dalton in his "Physiology."

The fluid portions gradually pass through the vessel walls, and enter the tissues in such proportion as their nourishment requires. The saline matters enter at once into the composition of the parts, generally without undergoing any change. The phosphate of lime is taken up in a large quantity by the bones and

cartilages, and in smaller quantity by the softer parts; the chlorides of sodium and potassium, the carbonates, sulphates, etc., are appropriated in special proportions by the several tissues according to the quantity necessary for their organization. The albuminous ingredients, on the other hand, are not only taken up in a similar manner, but at the same time are transformed by catalysis[1] and converted into new materials, characteristic of the different tissues. Thus is produced the musculin of the muscles, the ostein of the bones, the cartilagine of the cartilages, etc., etc. So the blood furnishes, directly or indirectly, all the materials necessary for the nutrition of the body.

There are also *four systems of circulation*, which will come into our province to study: two general and two partial—the tissue or nutritive circulation, the pulmonary or depurating, the portal or liver, and the kidney circulations.

Let us study alcohol in the light of the good or bad effects it has upon the principal organs concerned in these circulations.

I. THE ACTION OF ALCOHOL ON THE GENERAL OR NUTRITIVE SYSTEM.

The effects of alcohol on the heart and arteries has been very carefully studied by Dr. Marvaud, in France, and by Dr. Zimmerberg, in Germany; the former by the aid of the sphygmograph, or pulse-writer, and the latter by an instrument to ascertain

[1] Catalysis is that peculiar, indirect chemical change which takes place in one body which is similar to another in its chemical atoms, but of different form, so that it comes to possess the form of the latter without change of substance. The change of starch to sugar, and of blood to muscle illustrates this.

the force of the heart-beats, or pressure of the blood in the arteries. The results to which they came were: That very small doses of liquor increase the strength and frequency of the pulse; that larger doses increase at first and then diminish the heart's action; that very large doses depress from the first. According to Zimmerberg, the blood pressure might be weakened 15–19 per cent., which effect he attributed to the action of the spirit on the extremities of the nerves in the stomach. Certain experiments of Dr. Marvaud seem to show that this depression was due to the action of the alcohol in the circulatory system itself, as well as upon the nerves outside of it.

But Prof. Martin, of Johns Hopkins University, one of the foremost experimenters in physiology in this country, aided by the fine instruments of precision of that highly-endowed University, has made many experiments to demonstrate the action of alcohol on the heart, and has found by comparison that an ounce of whisky or brandy *always lessens* the *force* of that organ, though generally increasing its *frequency*. But frequency is often only the indication of weakness, as is so often seen in disease and when the physical powers are going out in death. This weakness, so clearly made out from an ounce of such spirits, becomes more and more decided as the dose is increased. This is an unequivocal demonstration which must be accepted. Dr. B. W. Richardson, of London, also studied the heart with the aid of instruments of precision, showing that the heart beat was decidedly altered in persons much short of inebriety. Total abstinence and time were both necessary to restore the heart to normal function again.

The habitual use of strong drink is certain to work a change in the structure of the muscular walls of the heart and arteries by supplanting the true muscle

substance by fat cells, whence the organs become permanently weak and flabby, and liable to burst, or cease to beat, at any moment.

At a late meeting of the British Temperance Medical Association, which now consists of three hundred and fifty-two members and seventy-two associates, Dr. W. Pearce, of St. Mary's Hospital, presented an interesting account of a newly-discovered form of disease due to alcoholism—"Acute Dilatation of the Heart."

Recently I was much impressed with a case in hand in which a young man of thirty-five, who had the habit of drinking, came down with hemorrhage of the lungs, and had limited pleurisy and pneumonia. His heart was beating at a rapid rate, but was extremely powerless, so much so he could not get on his feet without fainting, and even fainted away lying in bed. His nerves were also so unstrung by the habit, that the lung trouble tilted him into delirium tremens, which crowned all the other symptoms, making a blooming case indeed. Just while correcting this sheet a summons came to attend another man of about the same age. He was a man of business, wealth, and many friends, but a drinker. He expected to live many years. His parents were alive, and his grandfather saw ninety-six years; but, "they lived different lives from me." He had recently addressed his three newly-filled bottles of brandy: "I am your master. I will take you when I please, and when I have a mind to I will let you alone. You shall never rule me. If you ever do get the upper hand of me, that I cannot do with you as I like, there is a revolver in my drawer of the same pattern as that which killed President Lincoln, and it shall kill me." However, his drink had lain a mine in his system by changing his bloodvessels, easily set

off by a slight provocation, suddenly launching him into eternity. Think of it; a man boasting of his safety over a magazine with the fuse on fire! The Philistines rejoicing in their temple with Samson underneath! Such is the little drinkers know of themselves and the subtle enemy with which they have to do.

A most remarkable instance of the altering power of alcohol over the organic structure of the circulatory apparatus came under notice in a dissecting-room where I was demonstrating. The subject was a woman who had fallen down dead in the midst of her friends, and was returned: "Died of intemperance." On opening the body, every part was found to have undergone fatty degeneration. Some of the muscles of the face could hardly be made out. The liver was pale, hard, and greasy, much like the feeling of a cake of wet, hard soap. The kidneys were filled with fat globules, as the microscope showed. But the most interesting change was on the larger arteries. They were rough and earthy on the inside, and when pinched between the fingers, felt as though oyster-shells had been broken into sharp and irregular fragments, from a half an inch or more in size downward, and introduced into their walls. On laying the aorta open, it looked as though ulcerated over almost the entire surface, but this appearance was due to the fatty degeneration of the inner and middle coats, which had then become absorbed and the calcarious matter deposited in their place. The arteries had lost their elasticity, and were so tender that the body could not be injected. In consequence of this change, the walls of the aorta, after leaving the heart and while yet within the heart case, bulged out under the pressure of the blood from within into an aneurism, which finally burst, causing her instant death. The

heart case was full of blood, and the finger introduced at the rupture and carried down into the interior of the heart, detected the same kind of calcarious roughness there.

There are also other changes which the heart undergoes, so that Dr. Thomas Sewell, who held many autopsies on the bodies of the intemperate, observes: "I am inclined to think that the heart seldom escapes uninjured."

There is no doubt that alcohol is frequently the direct cause of that condition known as "overstrain of the heart," so often witnessed, particularly among athletes and soldiers.

We have already seen that the arteries are in great danger from the habitual use of alcohol. By the atheromatous, or fatty alteration they undergo, their walls get too weak to stand the action of the heart, and suddenly give way, or they distend into aneurismal tumors to burst at any moment. Those who have studied this subject most regard alcohol as the most important predisposing cause of arterial diseases.

When a drop of alcohol is put upon any group of living capillaries under the microscope, the vessels at once contract. After a few moments they dilate to much more than their ordinary size and become engorged with blood, "apparently," says Dr. Parkes, "from a sort of paralyzing action on the nerves." This engorgement is supposed to be most active in the surface capillaries so plainly witnessed in the face, eyes, and on the skin of inebriates; so there is no difficulty in accounting for the peculiar red nose of the toper, nor in explaining why they, more than abstainers, are such martyrs to blotches, erythema, boils, carbuncles, and the like. Indeed, "Who hath redness of eyes? They that tarry long at the wine."

Dr. John A. Stamps, of Wallaceburg, Ark., relates

that when he was a lad he had an ulcer on his leg, the inflammation and suffering of which were so greatly aggravated by a glass of blackberry wine which he took that he never forgot it, and when afterwards he entered practice, he was led by it to eschew stimulants whenever the patient was afflicted with any form of inflammatory disease.

Dr. V. Weyrich calls attention to the fact that those who have taken beer, wine, or spirits freely, perspire more profusely by reason of this capillary engorgement. Upon this principle we may also account for the frequent attacks of hemorrhage from certain portions of the mucous membrane, and for the various sores occurring about the mouth and nose of drunkards.

But we have additional means for explaining the capillary congestion—the presence of alcohol in the blood globules, by which their physiological functions are obstructed, as we saw when speaking of them, which prevents their forward movement. Long ago, the principle was demonstrated that the blood does not circulate through the capillaries simply by the *vis a-tergo* or power of the heart, but by an attraction of the blood globules for the walls of the capillary vessels themselves when performing their normal work. But the presence of alcohol, like the presence of carbonic acid in these globules, does measurably suspend their changes and destroy this attraction, so the blood cannot circulate as it otherwise would. The dark venous character of the capillaries of the skin of intoxicated people is a confirmation of this. And in dressing wounds on intoxicated persons, we notice how dark the blood is which escapes from the capillaries and smaller vessels. That impure blood will not readily circulate, but engorge the capillaries, is abundantly shown in the swelled face of persons suf-

fering from other diseases, as from croup or other forms of strangulation.

II. THE EFFECTS OF ALCOHOL ON THE PULMONARY CIRCULATION.

The object of this system of circulation is not to feed the body, like the general or systemic circulation, but to receive and purify the blood which has been on its nutritive rounds and returned to the heart in a venous condition. For this purpose it takes the blood from the right side of the heart, spreads it out over the many square yards of cell-surface in the lungs, where each globule, as it courses through the capillaries enveloping the cells, gives up its carbonic acid and is charged with a new portion of oxygen and goes back to the left side of the heart ready for another round in the general circulation.

Now, the effects of alcohol on this circulation are similar to what we find them in the first. In its presence the blood globules cannot undergo their proper changes and move along; hence, the whole pulmonary system becomes clogged just as if carbonic acid had been inhaled. The right side of the heart and the arteries leading from it to the lungs are engorged; the pulmonary capillaries distend with the dark blood; the breathing, at first regular, though somewhat quickened in frequency, soon becomes slower, embarrassed, difficult, sighing, or even snoring. If the dose be increased, things grow worse and worse. A portion of the dark, unchanged blood gets pushed along the capillaries into the veins, and comes back to the heart, and is again sent out to the tissues; the face and eyes become swollen and suffused, the neck, feet, and hands dark and cold; and the number of respirations decrease to but a few in a

minute, or even cease altogether. When this takes place, the heart follows suit and stops.

In the experiments of Lallemand, the breathing of a drunken horse decreased to four or five times in a minute. It has been claimed, because small doses of liquor do not kill as large ones do, that, therefore, small doses are not in the same line with the larger ones, and so do no evil. Now, it is a question how far a man may be justified in putting a poison into his system because Nature may, to a degree, overcome and expel it. Nevertheless, it would seem unreasonable to be putting that within one's self which can do no certain good, and at best is only a trig and a hindrance to healthful physiological processes. A little gravel occasionally with the corn may do no appreciable damage to the stones that grind the meal; but a constant stream of it, however small, will soon make it necessary to use the pick or abandon the mill.

We have already seen that even moderate doses of alcohol do affect the blood globules and interfere with the removal of the carbonic acid from the lungs, and, consequent upon this, there is a greater or less degree of congestion both in the lungs and in the capillaries of the systemic circulation. Such being the case, as is shown by the most certain evidences, we can hardly avoid asking, How does this state of the capillaries and the blood, brought about by liquor, conduce to the benefit of a person in consumption or tending to it? Here there is already an impairment of the substance of the lungs and an interference with the blood. How, then, can it be a benefit to further impoverish the blood, obstruct the capillary circulation, and impede the aëration, which, as everybody knows, is already under what it should be from the nature of the disease, and tends to grow less? Even in the early

stage, before any tubercles have formed, persons inclining to consumption eat less blood-making food and breathe less than in a healthy condition. Such being the facts, can the alcoholic treatment of consumptives be otherwise than harmful, since both the alcohol and the effects of the disease tend to cripple the functions of the blood? Moreover, we know that bronchial and consumptive disorders become rife among the intemperate, reaping fearful harvests as a result of their habits. Dr. Craigie is responsible for the statement that "all the spirit-drinkers he had ever seen or known, had been subject to chronic cough or difficult breathing, or had labored under chronic, dry bronchial disorder with asthma." Surely every one has been made familiar with the troublesome, tickling cough of old topers.

Dr. Lebert, who has seen much practice in Germany, France, and Switzerland, strongly condemns alcohol as a cause of consumption, and never intimates that it will help cure it. And no less an authority than Dr. Anstie insists that no form of consumption is so utterly fatal as that arising from alcohol. This form is usually what physicians call the "fibroid" consumption, corresponding to cirrhosis in other parts.

Dr. Woodbury, of the Philadelphia Medical Society, on this point says: "Nothing in clinical medicine is more certain than that the continual use of alcohol in even moderate doses stimulates the development of connective tissue all over the body; nothing in pathology more evident than the fact that alcohol is a prolific source of pulmonary disease; nothing in toxicology better established than the observation of the action exerted by alcohol upon the respiratory centre. For this reason it is especially dangerous in pulmonary consumption."

From such facts as the foregoing we may judge how very irrational is the liquor treatment of lung cases. Indeed, till the advocates of liquor give us more light in its favor, how can we look upon the liquor treatment of diseased lungs other than most injudicious if not positively criminal? To use it is to pour on oil, rather than water, to quench the fire.

III. EFFECTS OF ALCOHOL ON THE PORTAL CIRCULATION.

The liver or portal circulation, unlike the two former, is a partial circulation having to do with only a portion of the blood. Though the capillaries of this circulation expand throughout the liver, they have to do only with the blood gathered up along the alimentary tract charged with the substances of nutrition. This blood, having gone through the complex mill of the liver and furnished material for the production of the bile (which is the only secretion formed from other than arterial blood) joins the general circulation at the heart.

By this course of the blood, it will be seen that the liver is the first important organ, next to the stomach and bowels, to receive the force of alcoholic potations. And one will not be surprised to find, as Dr. Ogston has taught, that next to the damage which alcohol does to the nerves and lungs is the damage which it does to the liver. Going there more concentrated than it goes to any other organ, it can but be that it should seriously derange, irritate, and inflame it, and so set on foot a train of evils which must inevitably, sooner or later, prove disastrous.

It should be known that low chronic inflammations are rather constructive than directly destructive—that is to say, they, by the congestion, increase nutrition

in the part, particularly in the connective tissue of the part. Hence, the part grows and gets firm and hard, and, if it is an organ, this increase of the connective tissue element must have room for itself; so it crowds and compresses the secreting glandular part imbedded in it.

Now, it is exactly in this way that a frequent form of disease is brought about in the liver called the *whisky* or *gin-liver* in popular language, but by the profession as the *hob-nail* or the *cirrhotic* liver. The liver is larger at first, but the new connective tissue soon shrinks, as it does in a scar, and so compresses the glands and shrinks and hardens the liver.

Of 20 cases of this disease seen by Prof. Austin Flint, of New York, 17 admitted intemperance, and another was not an abstainer. Of 24 cases caused by liquor, he found 23 drank spirits and one beer. Of the 23, 15 took the spirit raw, with the water afterwards if at all. Dr. Loomis, in his "Practice," states that "those who take alcohol before breakfast as well as through the day are almost certain to develop cirrhosis of the liver." So frequently is alcohol the cause of this disease, that Birch-Hirschfeld doubts if it is ever due to any other cause.

Dr. Wunderlich once came across two typical cases of this disease—two sisters of the ages of eleven and twelve respectively. At first they were thought to be exceptions to the general rule; but on further inquiry, it was ascertained that they both had been schnapps drinkers.

As a further evidence of the provoking nature of alcohol as a causation of the "gin-liver," it has been found that when the disease occurs before puberty, as it sometimes does, the proportion of cases is about equal between girls and boys, but in later life, when the use of liquor becomes much more common

among males, the disease vastly preponderates among them.

"As to the action of alcohol in the production of this disease," says Dr. Flint, "the explanation now commonly received is, that, passing readily into the portal blood from the stomach, and carried at once to the liver, it excites, by contact, inflammation of a low grade in the interlobular spaces, and hence exudation and the production of adventitious tissue."

Not only is cirrhosis found among drinking people, but it is demonstrable that alcohol will produce this peculiar change. This the following will show:

M. Straus presented to the Society of Biology, held in Paris July 16, 1887, the results of his and his assistant, Blocq's, experiments on twenty-four hares made to produce alcoholic cirrhosis of the liver. Invariable success followed with all the characteristic changes so often seen in human drinkers. M. Magnan, discussing this paper, stated that he had experimented on dogs, and that their alcoholism was the exact counterpart of alcoholism in men.

But there are *other diseases* of a chronic character such as albuminoid enlargement, tubercular changes, inflammations, atrophy of the portal canals and cells by the pressure of a shrinking exudation which has taken place around them, etc.; all of which must frequently be attributed to alcohol. Of 250 bodies of chronic drinkers which Dr. H. F. Formad, of Philadelphia, examined, 220, or 88 per cent., had fatty livers that were more or less enlarged. Dr. Musser went over the reports of the Pathological Society of Philadelphia in reference to the liver, and his findings supported the statements of Dr. Formad, and showed that the "gin-liver" was not so much the result of heavy drinking as of persistent use of spirits on an empty stomach. According to Dr. Edward Goodeve,

atrophy of the liver, which is so frequent in Europe, is to be ascribed chiefly to the use of alcoholic drinks among the people.

The writer was lately called to a young man who was well up to the evening before, when he went out and drank with some friends, taking the liquor on an empty stomach. That night, vomiting and pain in the right side came on, with high fever. Headache began and increased, followed by delirium and a general jaundiced condition. He was sent to the hospital, from which he was taken to his home to die. The disease was acute inflammation of the liver, brought on by the one broadside of alcohol poured point blank into the organ.

Moreover, it is no uncommon thing for the physician to witness cases of sickness suddenly brought on by indulgence in liquor. Many a time has the writer seen protracted ill-health result from the first drunk; while death itself has not infrequently uttered its warning against such an abuse of the body. There being, as we have said, no valves in the portal veins, we have an easy explanation for the blocking up and engorgement of the vessels below the liver when this organ is itself engorged and the circulation through it obstructed. Hence, we readily understand why topers are so commonly subject to piles, mucous discharges, hemorrhages, costiveness, etc., of the lower bowels. It is well that women do not so often become drunkards, else there would be an increase of their peculiar troubles, which are, as it is, sufficiently common.

But there is another disorder of a very serious nature which science is now laying at the doors of the liver—*diabetes mellitus*, or sugar in the urine. Till quite recently, this formidable affection has been regarded as having its seat in the kidneys; and it is so

classified in medical writings. Later researches, however, show that the sugar has been formed in the economy before it reaches the kidneys, and that these organs act only as strainers with respect to it, removing it from the blood just as they remove salt and various other substances. In seeking for the fountain-head of diabetic sugar, it is found that the liver is the great glycogenic, or sugar-originating factory of the body. In an ordinary state of health this substance is produced in just the proper amount for the uses for which it is intended, so that it is all disposed of in the organism, and does not pass off by the kidneys. If any cause interrupts the processes by which the sugar is consumed, while its manufacture goes on normally, there will come to be an over-supply of sugar in the blood, which, when it reaches 3 parts to a 1000 of the blood, will begin to pass off by the kidneys and appear in the urine. On the other hand, if an undue amount of it is formed (the consumption remaining normal) it will also accumulate in the circulation, and be eliminated by the kidneys. In either case, we have diabetes, the sugar irritating and diseasing the kidneys as it passes.

Later, we shall show that alcohol is a powerful irritant of the nervous system, and so, liable, through the nerves, to affect the processes by which sugar is used in the economy. For the present, our remarks will be confined to the action of alcohol in originating the sugar.

Dr. G. Harley, of the Royal Society of London, has taken this subject into consideration, and in an article which was published in the *Medical Times and Gazette* (October 21, 1865) he speaks as follows:

"It is a well-known fact that cases of diabetes are much more common in Great Britain than on the Continent, and I, like many others, attribute this to

the fact of a much greater quantity of alcoholic drinks being used among us than among European nations. A few years ago, while on a visit to Munich, in the course of conversation, Dr. Pfeüfer, the Professor of Clinical Medicine, told me that he had only one case of diabetes in the hospital during the whole six months he had been in Munich; whereas, while Professor in Heidelberg, although the hospital was much smaller, he had on an average four or five diabetic cases in the course of each year. Now, the only way to account for this difference was that the Munich Hospital draws its supply from a beer (Bavarian) drinking district, while the Heidelberg Hospital obtains its supply from the wine-drinking districts of the Rhine, etc. And, curious enough, it turned out that even the single case of diabetes Pfeüfer had in Munich, he added, came from the Palatinate."

So far as it went, however, Dr. Rosentein showed that Bavarian beer had exactly similar effects to wine in the production of diabetes, in a series of experiments which he made. Dr. Harley says there can be no difficulty in explaining this action of alcohol on the ground of its stimulant effect, since various substances which are capable of exciting the liver will produce diabetes. A small quantity only of alcohol injected into the portal circulation of healthy animals is sufficient to cause diabetic urine. This, Dr. Harley demonstrated, at the College of France, before a commission appointed by the Societé de Biologie. M. Bernard proved the same thing by putting the alcohol down through the stomach in a long tube and discharging it into that portion of the bowels whence it would be most directly carried into the liver. Bernard also found another fact, viz.: that six centimetres of alcohol, with an equal amount of water,

would cause the liver to secrete a large quantity of sugar even while the animal was fasting.

"If any one doubt the truth of the assertion," says Dr. Harley, "that stimulants excite diabetes, let him select a case of that form of the disease arising from excessive formation, and after having carefully estimated the daily amount of sugar eliminated by the patient, allow him to drink a few glasses of wine during the next few days, and watch the result. He will soon find that the ingestion of stimulants is followed by an increase of sugar, and if stimulants increase the amount of saccharine matter in the urine of the diabetic, we can easily understand how their excessive use may induce the disease in individuals *predisposed* to it."

Prof. Cyon, in an article communicated to the Imperial Academy of Sciences at St. Petersburg, confirms the opinion of Claude Bernard that a modified nerve influence of the liver may produce diabetes, and went further and showed this by direct stimulation of the nerves which supply this organ. Thus, the dilatation of the capillaries and the consequent congestion of the liver, according to Bernard's theory, just meet the condition of things which Dr. Harley has demonstrated to take place by the irritation of alcohol, and which, if kept up for a length of time, may result in permanent diabetes.

The above theory and practical effects of alcohol on the liver, in producing and in keeping up this sadly fatal disease, somewhat painfully reminds me of my early practice, when, under the advice of the "fathers," I withheld from diabetic patients all starchy and sugary foods and allowed them brandy. I have distinct remembrance of an excellent man who did very nicely on his antisugar diet, in which alcohol was also excluded, and from whom nearly

every trace of the sugar disappeared, but who, becoming uneasy on account of the absence of his usual alcoholic potation, was allowed to return moderately to his cups, when his disease grew rapidly worse and carried him off.

The writer has noticed that in jaundice and certain other bilious disorders, alcoholic drinks or medicines prepared in alcohol are decidedly prejudicial and aggravating. This Dr. Chambers has also noticed.

How alcohol can be other than a fearful evil in hot countries and in bilious regions it is impossible to see. Even in temperate climates has not Dr. James B. Kirk the right of it, when, speaking of a large proportion of bilious complaints, he says they are "only the effect of an irritated and diseased liver, resulting from the repetition of alcoholic stimulus; and then comes wasting of the strength, and emaciation of the body, premature old age, uselessness and helplessness, till dropsy kindly releases the wretch from that vulture which ever preys upon him?"

IV. EFFECTS OF ALCOHOL ON THE RENAL SYSTEM.

The kidneys constitute another local system of circulation, which more naturally comes in here than elsewhere.

Together, the kidneys weigh $\frac{1}{166}$ as much as the whole body. They are supplied with arterial blood, which, having given up water, urea, salt, and certain other substances, either secreted or simply strained from it, returns from the kidneys nearly as bright and fresh as when it entered them. There is in this respect great contrast between the blood supplying the kidneys and the portal blood, which is the darkest to be found in the body. While the lungs are concerned in removing carbonic acid—the ashes of the furnace—it is the peculiar province of the kidneys to remove

the products of the wear and tear of the bodily machinery—the wasted nerve and muscle—in the form of urea or other crystallizable substances, the presence of which in the economy for any considerable time is attended with disastrous results.

Now, nature has put these organs, charged with so important work, as far away as possible from any source of irritation. Could alcohol get as direct access to them as it does to the liver, there is no doubt that their function would be destroyed almost at once, since the change wrought in arterial blood by alcohol is very much more extensive and damaging than that wrought in such venous blood as the liver receives from the portal veins. Thus, while the liver takes the alcohol immediately from the alimentary canal, the kidneys receive it only after it has passed through the liver, the heart, the lungs, and the heart again; by which time much of it has escaped, while the remainder has been greatly diluted by the blood of the general circulation; yet coming to the kidneys even so considerably diluted, it has power to congest, irritate, and excite them to the excretion of an unusual amount of the watery elements of the urine, as if to wash the irritant away.

But it is only the watery element that is increased, not the urea, which is the peculiar substance representing the waste of vital action, and is a poison to the system; this it is the special office of the kidneys to remove. And not only does alcohol not increase its elimination, but actually lessens the discharge. And should the irritation of the spirit continue or be augmented in force, inflammation would follow, and the excretion of urea nearly or entirely cease and life be in the greatest jeopardy. Relief or death then must speedily follow. In just this way one of the most accomplished professors of surgery

in the United States, and a brilliant operator, lost his life by "uræmia." And why was not the truth told in his case? He loved liquor, and had been on a free indulgence, which congested and inflamed the kidneys and shut them up. Hence, suppression of urea, uræmia, and death were as natural an outcome as the explosion of Uncle Bailey's well-filled powderhorn, while he stood pouring a stream of the powder on a coal of fire.

I have just been called to two men for "stoppage" of water from irritation of drink on the neck of the bladder, one of whom suffered a protracted siege of sickness, with inflammation of the prostate consequent on his folly.

There are two other forms of grave disease of the kidneys of which alcoholic liquor is the most prominent cause. They are:

(1) *Acute Albuminuria or "Desquamative Nephritis."*—This disease expresses itself in general dropsy from the congestion and blocking up of the tubules of these organs. When this nephritis occurs independently of alcohol, it is usually after diphtheria, scarlet fever, and such other eruptive diseases as produce congestion and exfoliation from the interior of the kidneys. "As a primary affection," Dr. Flint states that "it occurs especially in persons addicted to intemperance, and is not infrequently developed after lying on the ground in a state of intoxication." A case of this kind is under my care at this writing, he having been a liquor seller and drinker.

But recently a fatal case of the kind came into my hands in the person of a total abstainer, but whose business, for the past twenty years, had been in a rectifying establishment, where he was much exposed to the vapors of alcohol, often very strong. But whatever be the cause of this disease, nothing is plainer

than that alcohol should be excluded in any attempt to treat it.

(2) *Bright's Disease.*—This disease consists in a permanently altered condition of the tissual structure of the kidneys and, of course, of their functions. Hence, albumen appears in the urine, and dropsy bloats the body. After much study of this affection, the great Scotch professor, Dr. Christison, deliberately stated that alcoholic liquors caused at least *three-fourths* of all the cases. He also found that the *long-continued moderate use of spirit* acted in this way more surely than an occasional *large excess.*

Dr. H. Bence Jones, of the Royal Society, said: "No doubt the alcohol acts on the vessels and ducts; but not so powerfully as on the interstitial texture." "The increased flow of blood, the altered nutrition are identical in kind with the first actions of inflammation; and when the series of actions are repeated over and over again for years, the result is the same as might have been produced in a shorter time by an ordinary inflammation when no alcohol whatever has been taken."

Dr. William Roberts, of Manchester, England, said: "The abuse of spirituous liquors ranks high—probably higher than any other single circumstance—as a determining cause of Bright's disease."

Dr. S. J. Goodfellow, Physician to the Middlesex Hospital, regards it an unquestionable fact, that alcoholic compounds are a very frequent cause of kidney disease and albuminous urine. That the *vapor of alcohol* is capable of doing mischief to the body, Dr. Goodfellow firmly believes; and he relates the case of a tapster in whom nothing had any effect in relieving his albuminous urine until he left off his occupation, and this occurred several times, the albumen returning every time he returned to it.

Cirrhosis of the kidneys, corresponding to cirrhosis of the liver, is frequently produced in the same way. I have a specimen in which the kidneys are hard and contracted to about one-half of their normal size; hence their crippled function and the death of the patient.

There are still other forms of disease of these organs often referable to alcohol as their cause, but which my plans will not allow me to consider. Suffice it, these forms of disease are only common among a liquor-using people.

V. HOW ALCOHOL IS FINALLY GOT RID OF FROM THE BLOOD.

Having passed in brief review the action of alcohol on the several emunctory organs, we very naturally come to the manner of its final disposal of by the blood and the body.

It will be remembered that we have not yet found any positive proof of its digestion, or that it undergoes any other transformation. Indeed, its chemical nature and its known modes of change should have taught us better than to have expected it. But if it be not transformed or used in the body, it must be thrown out as alcohol in some way or other.

This then brings us face to face with the most important of the present unsolved problems in studying the physiology of alcohol; and its settlement would also have long ago cleared away most of the obscurity hanging over strong drink as related to the human body. We therefore here bring together such facts as have a bearing upon the disposal of alcohol by the organism, and when these come short of all the truths desired we shall consider certain circumstantial evidence, not doubting but that it is as allowable in establishing scientific questions as it is in

courts where life and death are determined by the probability it sustains.

As far as we have now seen, all the known facts point distinctly to what the French savants, Lallemand, Perrin, and Duroy, asserted to be the case, viz.: that alcohol is eliminated from the body "in totality and unchanged."

Elsewhere we noted the fact that a portion of the spirit taken into the stomach was discharged in connection with the feces. It now remains to consider what the kidneys, skin, and lungs do with it.

(1) *Elimination of Alcohol by the Kidneys.*—It is through these organs that the French savants, just referred to, supposed that most of it did find exit, and others have since supposed the same. Our views, however, differ from them, for we cannot believe that we can rationally expect such to be the case since we have no positive evidence to show that the kidneys have any special power over alcohol to excrete it. They excrete urea, for that is their business, together with certain other compounds, while they simply *allow* such other substances as have affinity for water, and are held in solution in it, *to pass out* through them in connection with the water. Thus, the odorous principle of asparagus, excess of albumen, sugar, and salt go out. Thus, too, alcohol, which we have seen has a strong affinity for water and is diffused everywhere where water is to be found in the body, escapes from the kidneys with the water of the urine, irritating the kidneys as it passes, and decreasing in per cent. as the per cent. of the alcohol decreases in the blood. At first, when a free dose of spirit is drunk, there is a large escape of it in the urine, but later on, after it has had time to pervade the more fixed fluids of the tissues and the amount in the bloodvessels is greatly diminished,

only a small amount comes away by the kidneys. Then as it again gradually works back from the tissues into the blood-current, the kidneys continue to allow it to escape through them, and that for many hours.

Let us follow this thought a little further:

If the blood of an ordinary size man be, what it is supposed to be, about two hundred and eighty ounces, and one ounce of alcohol be absorbed into the blood, then $\frac{1}{280}$ part or .036 per cent. of the volume of his blood will be alcohol. Allowing that the kidneys carry off thirty to fifty ounces of fluid daily—their usual amount—then we may look for one-ninth to one-sixth of that ounce of alcohol in the urine, provided none escape in other directions. But as it does we must look for less. By no means can the proportion of alcohol in the urine exceed its relative proportion in the blood from which the urine is derived unless we assume, which we cannot, that the kidneys have a special power over the alcohol to excrete it. This shows the common error of physiologists when they assume that if alcohol be not transformed in the economy it should be found in the urine. This was the capital mistake of the late Governor Andrew in his great, but most specious plea on behalf of the liquor interest before the Committee of the Legislature of Massachusetts in 1867. But it was only the same others have made and are still making.

The only rational position with our present knowledge is this: *There is no tissue or organ in the body which has power over alcohol to decompose and assimilate it; and there is no organ which has power over it to excrete it.* As alcohol it enters the circulation, as alcohol it pervades the tissues, and as alcohol it escapes from the organism. It is a stranger, a foreigner

to the animal economy. Like Bunyan's stragglers, it clambers over the wall into the way; like them again it clambers out over the wall on the other side and disappears across lots.

Having said thus much on the principles involved, I have only to add that the kidneys do of necessity throw off a small per cent. of alcohol, which may continue to be discharged for many hours. Lallemand found it in the urine after fourteen hours. Dr. J. C. White, of Boston, finished taking wine at 10 o'clock at night, and found spirit in the urine as late as 4 P.M. the following day, or for eighteen hours. Dupré, of the Westminster Hospital, London, says it continues to escape for from nine to twenty-four hours after ingestion. Prof. Perrin extracted enough to burn with its peculiar blue flame. Dr. Sabbotin collected 2 per cent. of what he gave by the end of five hours.

(2) *Escape of Alcohol by the Skin and Lungs.*—The kidneys being excluded, as they are, from the atmosphere can allow the alcohol to escape only in connection with the water. Both the skin and the lungs, on the other hand, are bathed with moist air, and hence permit the alcohol to be exhaled in the water which goes off and, also, as vapor which directly mingles with the atmosphere in contact with it. Thus, both its affinity for water and its volatility are brought into favorable conditions by these organs for its rapid removal from the body. Ordinarily, forty to fifty ounces of fluid escape by these two outlets, which, allowing the water to contain as much alcohol as the excretion from the kidneys, would give a considerable more alcohol by these two ways than could possibly find exit by the kidneys.

One of the most important offices of the skin is to regulate bodily heat. For this purpose it is pierced

by sweat ducts, to the number of three or more millions, which open under the cuticle while their inner end is coiled up into a ball or *glomerulus* in the depth of the skin. If straightened out, this mass of ducts would form a tube variously estimated from two and a half to twenty-eight miles long. These ducts are enclosed in a capillary network. Secreting water, salt, and other substances from the blood, they discharge their contents into the spongy cuticle where the sweat gradually evaporates, or, when in excess, runs off in drops. In this way from thirty or more ounces of fluid daily escape, producing a very great decrease of heat to the surface, so that the body resembles those porous vases, or alcarrazas, used for the purpose of cooling water by evaporation from the outside. And we cannot avoid the thought that a part of the cooling effect of alcohol on the body, so universally admitted, is due to its escape in this way, and not wholly by its interference with the functions of the blood globules.

We have already noticed that alcohol produces congestion of the cutaneous capillaries, a fact also true of the lungs. With this increased congestion there is an increase of aqueous exhalation, showing that the system seems to be aware of the presence of an enemy, and awakens to activity to wash it away, just as the eyes attempt to do when foreign substances get into them.

Immediately upon the entrance of alcohol into the circulation it begins to show itself in the expired air, and this escape continues long after the alcohol ceases to be found in the urine. And if the lungs do not discharge as much water as escapes by the kidneys and the skin, they contain much more favorable conditions for rapid evaporation, as the following will show:

Latest German and French physiological researches make out that the air cells of the lungs would, if opened and spread out, cover a surface of about 2152 square feet, or an area 108 feet long by 20 feet wide, or considerably more than the area of my city house lot, garden and all. Of this cell surface the capillaries cover three-fourths, or 1614 square feet, through which the whole bulk of the blood passes about every half-minute, and that in close contact with the air. Thus, we have in the lungs a mixture of volatile alcohol and blood spread out to a thinness below $\frac{1}{3000}$ of an inch, over an area of nearly 2000 square feet, under a temperature of 98°, and that with a moist breeze constantly playing over it. Could conditions be more favorable for free evaporation of the alcohol unless it were actually poured out on the street in the middle of a breezy summer's day?

But the objection is made that all the alcohol cannot be detected as so escaping. Very well. Nor can all the alcohol be detected which is mixed with freshly-drawn blood, though sought for immediately. The fact is, blood has power, in some way which we do not yet understand, of concealing a considerable portion of the alcohol which is once mingled with it, so that our present chemical reagents cannot detect it. This difficulty Prof. Perrin noticed and frankly acknowledged, after the spirits were once mixed with the animal odors. Most certainly, there is no ground from this to assume the oxidation of the alcohol and its appropriation by the tissues in a useful way, because we cannot detect the whole of the alcohol in the excretions, any more than is its mixture with freshly-drawn blood and our failure to extract it a proof of the same thing. We must, therefore, blame our chemistry, rather than our principles. It belongs, therefore, to those who take the ground of its

useful oxidation in the body to show it, since such an assumption lies against all the facts we know.

But there is another series of facts which makes in favor of its elimination rather than its consumption in the organism. I mean the

Different Effects of the Alcohols Having Different Degrees of Volatility.

Dr. B. W. Richardson, of London, made various experiments in this direction, and reported the results in the *Medical Times and Gazette*, March 7, 1868.

We have seen that methylic alcohol boils at 151°, ethylic at 172°, and amylic at 270°; their vapor density being, respectively, 16, 23, and 44. These alcohols will all evaporate at ordinary temperatures, and their vapors will intoxicate. If now, as Dr. Richardson showed, under the same common temperature, we expose a guinea-pig to the vapors of each, the pig in the methylic vapor will fall down dead-drunk in half an hour; the one in the ethylic in an hour and five minutes; while two hours are required for the one in the amylic. If then, the boxes be opened and air at the same temperature be let in, they will recover in four, eight, and sixteen hours, respectively. The pig subjected to the amylic intoxication will lose seven or eight degrees of temperature; "will have all the shiverings and rigors incident always to recovery from what is mildly called 'a drop too much,' and for a day or two later it will be colder than is natural, and more depressed."

If the vapor of the methylic alcohol be lowered to 45° temperature, the ethylic to 60°, and the amylic be raised to 100°, and the animals again introduced, they will all become intoxicated at about the same time, and if pure air of corresponding temperatures be introduced, they will rally together.

Even common people have noticed that intoxicated persons recover much sooner when placed in a warm room or before a good fire than when kept in a cool room. This experience confirms our theory as to the disposal which the body makes of the alcohol which is put into it, and shows that to put a person into a cold place to recover from an intoxicating dose of liquor is a physiological barbarism. Such, however, has too often been practised by our city police, and death rather than recovery has been the consequence. The British physicians have called attention to this subject, and everybody should know that heat and not cold is the proper treatment for the intoxicated.

The following statement by Dr. Richardson is a direct and valuable testimony to our line of thinking. Says he: "The temperature which directly governs the introduction of the vapor into the animal's body indirectly governs its expulsion. In all the cases the poison was expelled from the body by the direct influence of the animal's own caloric; so, in proportion as it could obtain caloric from the surrounding medium, it was enabled to eliminate the more freely, and so the animal in the warm air, although charged with the heavier poison, was, by the direct action of the caloric about it enabled to extricate itself from intoxication as quickly as its fellows with the lighter burdens."

If alcohol is oxidized in the body it ought to oxidize all the more readily as vapor, which is not the case, as the foregoing experiments plainly prove. When mixed with blood, though it cannot all be recovered, the blood is not the warmer for it.

What we have just seen shows that two causes operate to affect the anticipated results from a portion of spirits or wine, viz.: *temperature* and the *kind of alcohol taken.* Thus, as Dr. Richardson says: "We

take a few glasses of wine to-day, and to-morrow there is no bad result—no headache, no nausea, no coldness, no prostration. We take the same quantity of the same name of wine on another occasion, and all the objectionable symptoms above noted are present." So, in disease, there is no dependence upon effects unless the kind of alcohol be positively known and the physician is able to control the circumstances which govern its action; for, by ordering alcohol under the loose name of gin, brandy, wine, etc., to be used under any circumstances, there can be no conception of what is given, nor what must be the effects, and the whole thing is a senseless quackery, as everybody must see.

That alcohol is chiefly thrown off by volatilization has further countenance from the effects of varying *atmospheric pressure* upon intoxication. It is well known that in low, damp places persons easily become intoxicated, and remain so a long time; while far up in the air, as in balloons or on high mountains, where the atmosphere is greatly rarified and the pressure light, and, consequently, the conditions of evaporation greatly enhanced, enormous quantities of spirits are said to be easily borne. At such elevations also there is little oxygen in the air, so that it is useless to talk of the oxidation of the alcohol. Moreover, if we add to all this the fact that alcohol does not confine itself to the circulation, but goes into all moist parts, from which it must slowly distil back into the current, we have a very clear reason why alcohol, though it escapes in the form of vapor, does not escape at once. Sulphuric ether is much more volatile, and one thinks not of its oxidation in the body, but expects it to be eliminated by the lungs; yet it does not do so at once, but requires several hours for it, as its stronger odor enables us to know.

But yesterday I plainly detected it in the breath forty-eight hours after I had administered it.

When, therefore, we do know that alcohol remains a great while in the body without change (Dr. Percy having found it in the brains of rabbits as late as thirty-six hours after administration); when we do know that a very considerable proportion of what has been taken can be proved to escape, even under the acknowledged difficulty of extracting it from the animal odors (Dr. Sabbotin showing as high as 16 per cent. in the twenty-four hours); and when there is no direct proof for its oxidation or that any known use is made of it within the body at all—until some such proof is given, it is, to my mind, perfectly logical to conclude that all of it does go in the direction where so much of it is directly proved to go, and where such a host of physiological considerations unmistakably point that it should go. Why should we find so much direct and indirect evidence for the elimination of alcohol, and not one contrary proof, and yet accept the contrary?—an unknown against the known. Who in the light of this reasoning believes alcohol is consumed does so not only without proof, but against proof of a very weighty kind.

VIII. Alcohol on the Nervous System.

The effect of alcohol on the brain and nerves is, after all, the most important of its actions, and its consideration has been left till now that I might follow up the stream of alcoholized blood in regular order through the other parts first. As there is no portion of the body to which the blood is not sent, so there is no portion of the nervous system which is not affected by alcohol when in the circulation.

Comparatively few vessels, however, dip directly down into the nerve tissue, but they course in great

numbers along the sheaths of the nerves and spread out into large lakes or sinuses on the borders of the brain, so that some physiologists tell us that five times more blood goes to the brain than to any other equally large part, insuring an abundant blood supply to this important region.

We have seen how a moderate dose of alcohol excites and quickens the heart, partly, probably by sympathetic relations through the fiery liquid on the stomach, and partly, also, by its direct irritation of the interior of the heart itself. With increased motion at the centre, the blood is pushed rapidly forward into the arteries, which in turn throb and beat actively, while the capillaries swell and become red. The body grows warm on the outside, sweat starts, and the head feels full and oppressed. The mind becomes sluggish in some, but in the majority exhilaration is experienced, pains and aches flee apace, hopes brighten, cares cease to cause anxiety, and poets fancy

It makes the old man young again.

But does any of the spirit enter the brain, or nerve substance itself. Yes! Long ago, J. Frank and, after him, Ogston, Tardieu, and others noticed an alcoholic odor on opening the skull of those who had died when under the influence of liquor, and that, too, after considerable time. Lallemand, Perrin, and Duroy fed six dogs on alcoholic food, opened their brains, cleansed them from blood and bloodvessels, chopped them fine, and distilled alcohol from them sufficient to burn. Since then, "alcohol on the brain" has been a demonstrated fact.

What causes it to enter the substance of the brain?

The above French savants happening to find more alcohol in the brain at the time they made their analysis than in the blood itself, very naturally concluded

that it was *because of some special elective affinity for the brain and nerve matter as such* more than it had for other parts; which opinion has, singularly enough, become a very popular one. This is undoubtedly an error, and makes a break in the physiology of alcohol as we have hitherto seen it, requiring an abandonment of plain principles for a theory. A few words only will make our position clear.

1. *The time of the examination* after ingestion of alcohol makes a difference, since there is no appreciable moment when the spirit is equally diffused, even in parts equally moist; for, like the tide, it is subject to fluctuations. At the mouth of the river the tide is high ere it is high miles further up, and when the tide turns, the water falls at the river's mouth long before the slack reaches the inland points. Just so, when the flood of alcohol comes into the stomach it sets into the bloodvessels, and finally reaches high tide in the brain. Here it remains till decline begins in the blood below, after which it begins to recede; and just at this time it is possible to detect more alcohol in the brain than in the blood.

2. *Later experiments find more alcohol in the blood than in the brain, as a whole*, though not much, as there is but little difference in the amount of water between the two; for, next to the blood itself, the brain is the most watery part of the body.

According to Robin and Verdeil, the blood has 79.5 per cent. of water, and the brain 78.9, or only .6 less. But the amount of water varies in different brains as well as at different times. L'Heritier finds as follows: In infants the per cent. is 82.79; in youth, 74.26; in adults, 72.51; in aged people, 73.85; and in idiots, 70.93. Thus is explained why children cannot bear much spirit, compared with the adult, and why the sapless idiot can, at times, carry off a

large amount and not seem to feel it. It also shows what a blunder a prominent Boston physician made when he plied his scarlet fever patients with hot wine, causing them to be frantic, as though their brains had become inflamed.

Since, then, as we have elsewhere shown, alcohol has great attraction for water, and now show the exceeding watery state of the brain, it is perfectly reasonable that more alcohol should enter the brain than goes into any other part except the blood, and, later on, after the tide turns and elimination from the blood begins, it may be in greater quantity than in the blood itself, there is here no ground to assume that alcohol has any special elective affinity for the substance of the brain and nerves as such. Hence, as we have good, philosophical basis for explanation of certain observed facts, we should hold to that basis and not fly to theory. We must, therefore, reject the conclusions, in this respect, of the learned Frenchman, that alcohol has any special affinity for brain matter as such.

I. ACTION OF ALCOHOL ON THE NERVOUS SYSTEM AS A WHOLE.

When Lallemand, Perrin, and Duroy gave forty to fifty grammes of brandy to dogs, they observed that the dogs became silent; had an uncertain, vacillating gait, followed by a kind of numbness; paralysis began in the posterior extremities and advanced to the rest of the muscular system. Anesthesia, or loss of feeling, always followed in regular order till it came to the mucous membrane of the eye, when the loss of feeling and motion became complete, and the animal lay in an apparent calm and quiet sleep. The pupils were dilated, but on the administration of each new dose they momentarily contracted and then dilated again.

At first, there is acceleration of pulse, growing large and bounding, afterwards decreasing in strength and frequency, in size and regularity, till scarcely perceptible. Respiration follows the same order, becoming very slow and irregular before ceasing. The heart continues beating till all else is still. Three periods are marked in the above symptoms:

(1) Period of excitement: Uncertainty of movement; increased frequency of pulse and breathing; and contraction of pupils.

(2) Period of perversion: Muscular power fails, beginning at the hind extremities; irregularity of pulse and respiration; dilatation of the pupils, changing from time to time to contraction.

(3) Period of collapse: Complete paralysis and loss of sensibility; feebleness of circulation and breathing; permanent dilatation of pupils; an arrest of respiration; arrest of heart.

This brief picture is an exact analogue of the physiological effects of alcohol on man, with this exception—that the first effects on him are in the derangement of the intellectual faculties. As Dr. Marvaud well says: "Delirium in man is the disorder which opens the scene, and which constitutes the phenomenon, followed by all the others;" while with animals it is the muscular system which "opens the scene" by irregularity of movements and uncertainty of step. Bearing this principal difference in mind, we can study the physiological action of alcohol, all we wish, through its effects on the lower animals.[1]

[1] Horses acquire a love for ale if fed to them in their provender. In Ceylon, the flies are attracted by the sugar of the palm, and get drunk on the toddy made from it. Birds are attracted by the flies, and also drink toddy, and the jabbering they make in the trees afterwards is remarkable. An old cock well "set up" is a full match for a first-class dandy full

Gubler pointed out *three particular stages or degrees of drunkenness*, and designated them as follows: 1, gentle intoxication; 2, complete intoxication; 3, comatose, or apoplectic intoxication.

Michael Levy, in a "Treatise on Public and Private Hygiene," says: "The influence of alcohol on the nervous system, and particularly on the brain, manifests itself by a progressive but constant series of symptoms, which, apart from their intensity, are reproduced in all individuals; it constitutes a veritable intoxication, and the morbid state which results unfolds three phases: excitement, perturbation, and loss of the functions of the cerebrospinal axis."

Following Dr. Marvaud, we present the most important symptoms of these three groups as follows:

First degree—Excitation of the intellect, abundance and vivacity of ideas, animation of speech, loquacity, agitation, uncouthness of gestures and movements.

A gentle but temporary flush of heat, acceleration of pulse and respiration; with injection and turgescence of the skin of the face, and sometimes sweating.

Second degree—Dulness of intelligence; incoherence in word and thought; irregularity and indecision in the movements.

Perversion of sensibility; imaginary sensations; tingling of the ears and buzzing. Derangement of vision. Feeling of constriction of the forehead.

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of wine. After the birds, comes the palm cat, to find an easy prey and a pleasant drink. Domestic fowls also easily acquire the habit of intoxication, but show the redness on their combs instead of their noses. As in man, their course is downward. Fatty degeneration of the tissues takes place, and bloating and death speedily follow. The only difference between them and man is that they accomplish in two months what usually requires several years to do in the human species.

Incoördination of the movements; indecision and irregularity in the muscular contractions; uncertain and trembling walk. Loss of equilibrium.

Redness of face; swelling of jugulars; contraction of the pupils. Fulness of the pulse; irregularity and embarrassment of the respiration and circulation.

Third degree—Complete suspension of intelligence, sensibility, and movements. Torpor of the senses, and involuntary evacuation of the urine and feces.

Face pale and haggard; eyes dull and glassy, with pupils permanently dilated.

Pulse small and bad; respiration snoring. Inertia complete.

As a result of this state of things, profound slumber follows, sometimes interrupted by dreams, and attended by a copious sweating. This sleep, which usually continues for many hours, may be prolonged from six to twenty-four and even forty-eight.

To these may be added certain consecutive phenomena—such as feeling of general prostration, heaviness of the head, and depression, which are rarely ever wanting, and sometimes oppression of the stomach, nausea and vomiting, and bilious diarrhea.

This third degree is very much to be feared, since, according to Devergie (*Legal Medicine*) one-tenth of the cases die; while many are thrown into violent sickness, from which they but slowly recover.

That there are exceptions to the exhilarating action of alcohol is true. Some cannot take any appreciable quantity that does not depress the mind and render them stupid and dull, and that, too, in proportion to the amount taken.

There is to be noted a close similarity of action between the imperfectly aërated blood of consumptives and the condition brought about by the presence of alcohol in the circulation, which, as we have seen,

prevents the perfect aëration of the blood globules. In the one case, a portion of the aërating surface of the lung is destroyed; in the other, the power of the globules themselves is impaired. In both, depression of mind is rare. In both, mental exhilaration is proverbial. Both are of the nature of partial asphyxia. Both give out a sickening odor from the skin.

II. HOW ALCOHOL ACTS ON THE NERVOUS CENTRES.

There are two classes of anesthetics—the true and the false.

The true—such as ether, chloroform, and some others—act directly upon the nervous system; the false—such as nitrous oxide, carbonic oxide, and carbonic acid—act primarily on the blood globules, checking their normal physiology, and in this way finally act upon the nerves.

Alcohol appears to fall into a class of its own, between the two, having, in a degree, a true anesthetic effect by direct action on the nerves, and an undoubted influence over the function of the blood globules, by which they are made to act as though charged with carbonic acid like the agents of the second class.

Medical men long ago observed the fact that alcohol abolishes sensibility, and the literature of this subject is replete with instances prior to the discovery of ether, in 1846. It was then common for persons about to undergo a surgical operation to drink strong alcoholic liquids to mitigate the suffering. In the Hotel Dieu d'Amiens a drunken woman was confined without pain. Blondin amputated the thigh of a drunken man, who remained insensible during the operation. A man in Chicago, while intoxicated, dislocated his hip, which Dr. N. S. Davis set by the aid of mechanical appliances, the patient knowing

nothing about it till afterwards. A man in Canada, under the influence of liquor, laid down to sleep with his arm over the rail of a car-track, and was not awakened by the train, which cut off the arm. Formerly, it was common to give large draughts of alcoholics to produce muscular relaxation to favor the reduction of difficult dislocations. Every one must have noticed with how little suffering drunken persons fight and tumble about and cut and bruise themselves. An intoxicated man fell over a precipice a hundred feet high, and was not killed. Hence, it was concluded that alcohol, though dangerous to people on the top of a cliff, was serviceable to those who fell off.

Noticing carefully the symptoms of alcoholic intoxication and etherization, we are impressed with the close analogy between the two sets of phenomena, especially those pertaining wholly to the nerves.

Bouisson maintained that alcoholization and etherization were not the same, to which Dr. Marvaud replied, that although the ether and the chloroform were chemically different, they produced an etherization of the same nature. According to Guillemin, of Strasbourg, who wrote in 1868: "That which produces drunkenness in alcohol is the ether, or at least the radicle of ether, which it contains; chloroform itself is only an ether. If the principle of these bodies are analogous, why," says he, "deny the analogy of their action?" He admits that the action varies according to the radicle which the particular anesthetic contains. Elsewhere we have noticed that alcohols differ as their radicles differ. There is one point which makes on the side of Bouisson, viz.: If alcoholization is etherization, it is a singular etherization, since when thoroughly drunk, according to Devergie, one out of ten die, while thousands can be most thoroughly anesthetized with ether or chloroform

and all recover. Hundreds of thousands of the weak and sick have been under sulphuric ether without a single death, clearly proved to be directly due to it.

The deductions of Lallemand and Perrin are: 1. Alcohol and the anesthetics exert over the cerebro-spinal system a special action which is characteristic. 2. They produce, in the first place, an excitation more or less marked according to their nature. The period of the excitation appears to be in accordance with the solubility and volatility of them. They follow progressive action, suspending in order the sensibilities and the power of motion of the nervous system. 3. They accumulate in the nervous centres by virtue of a special elective affinity. [For the water, not necessarily for the substance, as we have shown.]

That these conclusions are just and true was most ably demonstrated by Claude Bernard of the College of France, as shown in his experiments published in 1869.

Marvaud says: "It is perfectly proved to-day that alcoholism and etherism are two states whose pathological conditions are identical, and whose symptomatic expression is analogous; apart from some slight differences which we easily comprehend, the influence of alcohol and ether on the nervous centres is followed by the same series of phenomena which always bring about the same results—anesthesia."

Even before the recent demonstrations in this direction, Prof. Davis used to tell the students at the Medical College of Chicago, that "alcohol is simply an anesthetic, a sedative to nervous sensibility, and *debilitating to all the physical functions.*"

If, now, we keep in mind these two effects of alcohol

—*obstruction to the vital changes in the tissues by the modification of the blood globules, and the etheral anesthetic and exciting influence over the nerves*—we can see how there can be at first exhilaration of pulse and mind, with weakness in both (so often mistaken for a tonic effect), and a subsequent prostration of both mind and body. Hence, Dr. Desguin, of Antwerp, in a paper published in the *Bulletin Générale de Thérapeutique* for October 25, 1875, concludes: "Two phases should be distinguished in the physiological action of alcohol and alcoholic drinks. *The first is characterized by excitation of all parts of the nervous system, ganglionary as well as cerebrospinal; the second, by the depression of all the acts of organic and animal life.*" And in proper therapeutics "*the last mode of action should be absolutely rejected;*" while "*the excitant action of alcohol is the only action to which we can and ought to have recourse in treatment.*" But the difficulty is to obtain the excitation without the depression, as much so as to thrust in a double-edged knife and cut only one way.

Claude Bernard and afterwards Dr. Marvaud made numerous experiments on rabbits by exposing their brains and administering alcohol and watching results. There was always a flushing and swelling up of the brain, forcing itself into the opening in the skull, and this increased on repetition of the dose. After some time, however, the vessels grew paler, the brain sank down, and there was less blood than before. This *anemic state* continued till the animal died. From experiments like these, as well as from observations upon the brains of persons who have died while under liquor, it is a fact which cannot be questioned that the circulation undergoes two successive modifications: 1, *hyperæmia* which accords with the period of excitement; 2, *anemia* which corresponds with the

period of insensibility and prostration, when the vaso-motor nerves themselves are also etherized.[1]

Drunkenness is caused, therefore, by the presence of alcohol in the blood globules and by its direct anesthetical action upon the nervous elements—an action the nature of which is unknown, and its characters are not determined, but which are, in some sense, an organic lesion, either transitory, as in acute drunkenness, or persistent, as in chronic delusion.

By the practice of cutting away successive portions of the nervous system in vivisecting animals, it has been possible to know what portion is associated with any given phenomenon. Hence, it has been ascertained that the cerebrum, the upper or large brain, is the seat of intelligence and volition; the cerebellum, or lower brain, regulates locomotion by coördinating the action of the will and the particular muscles concerned; the *pons Varolii* governs in the general and tactile sensibility; the *medulla oblongata* presides over the circulation and respiration. Thus, alcohol in man first affects the cerebrum and destroys the intellect and the reason; then the cerebellum, causing staggering; then the pons Varolii, deranging sensibility; then the spinal cord, when bodily feeling and motion are suspended; and last of all, the medulla

[1] The writer has experimented on rats, chloroforming and then swinging them by their tails to bring them to. Without swinging or suspension they always died. A son of Nélaton practised this on mice, and gave his father a hint that cerebral anemia was the cause of death in the use of chloroform—a fact which the great surgeon utilized with success in surgery, by inverting patients to let the blood flow into the head. Dr. J. M. Sims has lately reported a chloroformed patient so saved. A delicate boy under chloroform, under my care, suddenly turned pale and ceased respiration I at once inverted him, shook him, and even used artificial respiration before he reacted.

oblongata, when respiration and the action of the heart are suppressed.

Parchappe (*Annales Medico-psychologiques*) attempts to explain this remarkable peculiarity in the action of liquor by saying that the medulla oblongata has a very great force of resistance—more than all other nervous organs—against causes of destruction, and that it has a degree of vitality considerably above that of the brain and spinal cord.

Be Parchappe correct or not, it is certainly a wonderful provision of Providence against the drink habit that that short portion of the spinal cord from which the nerves spring that go to the heart and diaphragm maintains its power, when every other mental and bodily power has been destroyed, to keep the blood circulating and the lungs going to fan the poison out. Literally, the dead-drunken man is "within an inch of his life." A little later and even this small part loses its power; then respiration and the heart cease, after which beneficient nature can do no more than to dissolve back to earth the abused and dishonored body, which, notwithstanding its perfection of form, its adaptation and ready obedience to the behests of the will, is so cruelly insulted and shamefully divorced by drink.

III. HOW ALCOHOL KILLS.

There are two direct ways by which alcohol destroys life:

At once, smiting its victim down like a stroke of lightening:

By gradual poisoning within a brief period of time, in distinction from the more prolonged effects in which it sets in operation secondary agencies, under the cover of which it too often escapes responsibility.

1. Death is *suddenly ushered in* without warning,

particularly after excess with the stronger kinds. In this respect the results resemble the occasional mishaps from chloroform. Here, then, seems to be a peculiar susceptibility of the *medulla oblongata*, which loses its power at once over the functions of the diaphragm and heart. This sudden result is often attributed to nervous shock, and may be so at times. Elsewhere we have shown that some sudden deaths are most certainly owing to a suspension of the physiology of the blood globules, they being overwhelmed by the abundance of the spirit, just as yeast cells and similar bodies are overcome by it.

2. *In cases of slower death* by this agent there is usually added some untoward circumstance, as an impression of cold, a strong emotion, excitement of temper, exertion, etc., which strengthens the depression from the liquor and gives the fatal tilt. Such cases generally present the symptoms of apoplectic stupor, snoring, slowness of breathing, blueness of the lips and skin.

The learned Frenchmen so often referred to, Lallemand, Perrin and Duray, make no scruples in attributing death from alcohol to the toxic action exerted by this substance upon the brain. "It is true," say they, "that the autopsy indicates, among subjects who have died under the influence of liquor, a double congestion, a congestion of the lungs and brain, which looks like a primary asphyxia. But in reality, the primary cause of death ought to be placed in the functional alteration of the cerebrospinal nervous system—an alteration which originates and governs the progressive series of morbid phenomena."[1]

[1] As a result of numerous *postmortems* by Dr. John C. Peters, of New York, made on persons who died from drunkenness, he observes: "Invariably there was present more or less *congestion of the scalp and of the membranes* of the brain,

Arrested functions of the blood globules would give a similar series of phenomena; but the full power of alcohol over the blood cells was not understood when these savants wrote. They further say that "the modification and arrest of respiration prove the diminution and suspension of nervous excitation; there is asphyxia to be sure, but it is only indirect; it is the asphyxia which is consecutive to the abolition of the cerebrospinal functions." And Flourens observes that "in ordinary asphyxia the nervous system loses its force under the influence of dark blood—of blood deprived of oxygen; and in etherization, the nervous system loses its force at first under the direct action of the singular agent which causes the etherization."

It is evident, therefore, *that alcohol plays a double rôle in the human system—viz.: a true etherization of the cerebro-spinal nerves, to which is added the prostrating effects of a partial blood asphyxia.* This also explains the greater danger from alcohol, while its slower volatility, combined with its great affinity for water, accounts for its protracted intoxicating effects, as compared with ether, in persons who finally recover.

IV. SPECIAL FUNCTIONAL DISEASES OF THE NERVOUS SYSTEM FROM ALCOHOL.

From what we have seen of the peculiar action of alcohol on the cerebro-spinal system, first, by its special direct effects, and, secondly, by its indirect effects

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with considerable serous effusion under the arachnoid, while *the substance of the brain was unusually white and firm*, as if it had lain in alcohol for an hour or two. . . . The peculiar firmness of the brain was noticed several times, even when decomposition of the rest of the body had made considerable advance." Dr. Meredith Clymer, of the same city, confirms these *postmortem* appearances; and I can do the same.

through the medium of imperfect blood changes, we are prepared to expect that the present section must, of necessity, open up a wide field in which will be displayed most fearful consequences. And this expectation is true. And yet, we believe that there is a still wider field through which its action is felt in secondary and otherwise generally unrecognized influences over the constitution, and through the constitution over all other forms of disease, and specially over the physical, mental, and moral condition of the generation to follow. It is a tremendous truth that our own future is conditioned on the present; and that the next generation is plastic in this. Truly, may we say:

> Like clay, ye can mould it in the form ye will,
> What ye write on the tablet remains there still.

What troubles have come to ourselves from being "the degenerate children of degenerate sires," who can tell? What we inherit, in connection with the seed which we ourselves have sown, yields a double harvest both for ourselves and our children.

But in this brief work it is only possible to touch a few of the most prominent disorders originating in the action of alcohol on the nervous organism. We believe, however, that the number of things we say may be taken as an index to the still greater number unsaid.

Calling to mind the very delicate and watery character of the brain substance, the readiness with which alcohol seizes it, and the prolonged hold it makes upon it, it is no wonder that various serious disorders do spring from indulgence in strong drink.

Dr. Austin Flint says: "The habitual use of alcohol, beyond certain limits, produces a deleterious influence on the whole economy." We would ask:

What are these "limits?" We presume he means that an amount of liquor which the system can rid itself of and bring out of the fray every organ and tissue in its integrity, may be "safe limits." But when does that occur if any alcohol is taken? Alcohol in the body scorches like sin in the soul. "Can a man take fire in his bosom, and his clothes not be burned?" As of old, "Wine is a mocker; strong drink is raging; and *whosoever is deceived thereby is not wise.*" The "comfortable feeling" and the physical demand for more are deceptive and beyond "safe limits."

(1.) *The Acquired Habit.*—It is notorious that the nervous system, in which resides the *intelligent will*, is mainly under the government of that will. Like a child, it may be intelligently "brought up," or it may be allowed to "come up," and be stamped by all the accidents by the way; or worse yet, it may be indulged, pampered, and fooled with till the reins get into its own hands, when no power on earth or in heaven seems sufficient to control it. *Like the child, the nervous system must be held under proper discipline with plenty of lessons in self-denial in order to its good behavior.* Nothing needs the exercise of greater amount of good sense in its management. Tickle the taste for awhile and disgusting things become a delight. Pull out one hair for awhile and it is hard to keep the hand from the head. Scratch the body on retiring, and the body will demand scratching every night. Excite the stomach or the brain with an irritant, and these organs will require the excitation. Indeed, it is perfectly amazing to what lengths the nerves may go for good or for bad by habit.

A remarkable case was once presented to the writer. A lady had rubbed her shins before retiring till they had learned to require the excitation and

give delight in the indulgence. At length, it was impossible for her to let the limbs alone when she undressed. At no other time did they demand the excitation. The front of the limbs, from the knees to the feet was swollen, red, and scabby. Every night the itching and burning imperatively called for the finger nails, and great was the delight while she dug into the morbid part till the blood ran to the floor. The excitement over, smarting, burning, and aching followed, till it was near morning before she could get sleep. There was no original disease; it had all been produced by the habit thoughtlessly begun, till it could not be resisted. The plan for the treatment, of course, was not difficult—something to soothe, with abandonment of the excitation. A speedy cure resulted, though no cure was possible had she continued the excitation. This instance hints a great lesson of instruction.

The nervous system is like a cone. God made it to sit on its broad base and allow all ordinary fluctuation of life and habit without carrying the centre of gravity outside of the circle of its base. But they who violate nature or begin a false habit, turn that cone upon its peak, and then comes the everlasting difficulty to make it stand. Witness the tobacco man, the user of morphine, of cocaine, and every other person that gives way to morbid excitement.

The woman's shins is the exact philosophy of the drinker's brain and stomach. The more the indulgence is allowed, the greater is the perversion and demand.

How truly did the late, eminent Prof. Thomas C. Upham, in his "Mental Philosophy," describe the drinking habit: "The liquor has the power of stimulating the nervous system, and by means of this excitement it causes a degree of pleasure. This

pleasurable excitement is soon followed by a corresponding degree of languor and depression, to obtain relief from which, resort is again had to the intoxicating draught. This results not only in restoration, but an exhilaration of spirits; which is again followed by depression and distress. And, thus, resort is had, time after time, to the strong drink, until an appetite is formed, so strong as to subdue, lead, capture, and brutalize the subject of it. So that the only way to avoid the forming of such a habit, after the first erroneous step has been taken, is quietly to endure the subsequent unhappiness attendant on the pleasurable excitement of the intoxication, till the system has time to recover itself and to throw off its wretchedness by its own efforts."

"The bibber of wine and the drinker of ardent spirits readily acknowledge that the sensation was at first only moderately pleasing, and, perhaps, in the slightest degree. Every time they carried the intoxicating portion to their lips, the sensation grew more pleasing, and the desire for it waxed stronger."

"There is a threefold operation. The sensation of taste acquires an enhanced degree of pleasantness; the feeling of uneasiness is increased in a corresponding measure when the sensation is not indulged by drinking; and the desire, which is necessarily attendant on the uneasy feeling, becomes, in like manner, more and more imperative. To alleviate the uneasy feeling and this importunate desire the unhappy man goes again to his cups, and with a trembling hand pours down the delicious poison."

Linnæus said: "Man sinks gradually by this fell poison; first, he favors it, then warms to it, then burns for it, then is consumed by it."

Another most important fact must not be forgotten —the *catenation of morbid excitements*. One kind of

indulgence confuses the nervous system, breaches the wall of conscious integrity, and prepares the way to some other kind of indulgence. Tobacco leads to rum, and rum to crime. Had the great composer, Strauss, entitled his piece Tobacco, Wine, and Women, instead of "Wine, Women, and Song," he would have suggested a stronger but lower chain. Out of 700 convicts in the State Prison of New York, 600 confessed to getting there through the use of liquor, 500 of these to having learned to drink from using tobacco. The true philosophy of a cure of any one bad habit is to abandon them all; a substitutional treatment is a physiological and a philosophical mistake. Let a man become a *man* again, and, if to his physical redemption he adds the power of a Christian redemption, there is no higher help for him. He may be saved.

Continuing this study of alcohol on the nervous system, we consider briefly:

(2.) *Acute Alcoholism*, or "*delirium ebriosum.*" This is the result of large drinking, by which the brain gets over excited and the reason lost. It is a state closely resembling acute mania. The active delirium is characterized by frenzy and violence or by hilarity. There is pain in the head, increase of heat, throbbing of the arteries of the head and neck, thirst and apparent feverishness. In short, the symptoms are those commonly met in active cerebral congestion, though without the temperature. However, if the drink be abandoned, the person is likely to recover. But if the bane is continued, the digestion suffers, innutrition follows, and nervous poisoning increases till the activity of the symptoms so far decline as to cause the miserable person to pass into that peculiar disorder known as

(3.) *Delirium Tremens.*—Dr. William Aitken thus

describes it: It is "a train of morbid phenomena, produced by the slow and cumulative action of alcohol. Delirium is one of the most prominent features of the morbid state, which is otherwise characterized by hallucinations, dreads, tremors of the tendons and muscles of the hands and limbs, watchfulness, absence of sleep, great frequency of pulse. A thick, creamy fur loads the tongue, and a cool, humid, or perspiring surface prevails; while the body gives forth a peculiar odor, of a saccharo-alcoholic description, more or less strong."

Delirium tremens is preëminently a disease of this century, and chiefly confined to spirit-drinking.

The evil consequences of ardent spirits on the organs and textures of the body in this disease have been deduced from a careful study and comparison of the morbid appearances of a chronic character met with in the bodies of persons known to have lived intemperate lives, and who had perished suddenly from accident or suicide, and while in apparent health and activity. "The extent of the chronic changes," using the words of Dr. Aitken, "in the various organs of these individuals is found to have been *far in excess* of what could have been reasonably looked for in a like number of persons of the same age, and of temperate habits, suddenly cut off while apparently in average health and vigor."

Dr. Ogston has most clearly proved the truth of the theoretical conclusions as to the cumulative action of the protracted use of strong drink by the results of extended observations in postmortems. Dr. Thomas Sewell, after having examined more than three hundred bodies of those who had been addicted to the use of alcohol declares to the same effect.

How a person feels in delirium tremens can best be

told by John B. Gough, who relates his own personal experience thus: "For three days I endured more agony than pen could describe, even were it guided by the hand of a Dante. Who can tell the horrors of that horrible malady, aggravated, as it is, by the almost ever-abiding consciousness that it is self-sought? Hideous faces appeared on the walls, and on the ceiling, and on the floors; foul things crept along the bed-clothes, and glaring eyes peered into mine. I was at one time surrounded by millions of monstrous spiders which crawled slowly, slowly over every limb; whilst beaded drops of perspiration would start to my brow, and my limbs would shiver till the bed rattled again. Strange lights would dance before my eyes, and then suddenly the very blackness of darkness would appall me by its dense gloom. All at once, whilst gazing at a frightful creation of my distempered mind, I seemed struck with sudden blindness. I knew a candle was burning in the room, but I could not see it. All was so pitchy dark. I lost the sense of feeling, too, for, I endeavored to grasp my arm in one hand, but consciousness was gone. I put my hand to my side, my head, but felt nothing, and still I knew my limbs and my frame *were* there. And then the scene would change. I was falling—falling swiftly as an arrow—far down into some terrible abyss; and so like reality was it, that, as I fell, I could see the rocky sides of the horrible shaft, where mocking, gibing, mowing, fiend-like forms were perched; and I could feel the air rushing past me, making my hair stream out by the force of the unwholesome blast. Then the paroxysm sometimes ceased for a few moments, and I would sink back on my pallet drenched with perspiration, utterly exhausted, and feeling a dreadful certainty of the renewal of my torments."

Dr. Aitken attended the autopsy of a man who had been a free user of brandy for a long time, and found characteristic degeneration of nearly every important organ of the body, including the bloodvessels. He says: "The prolonged action of the alcoholic poison on the cranial contents is to produce *induration of the cerebral and cerebellar substance in by far the largest number of cases,* coincident with an increased amount of water in the membranes of the brain; while the fatty degeneration of the small arteries leads to atrophy of the convolutions and dropsy in the parts." Hence, ensues the great complications—such as profound stupor, fainting, suffocation, exhaustion, epilepsy, and convulsions, in which such persons generally die.

That an exceeding prostration attends delirium tremens is shown by the fact that more than twice the number of persons die of the disease in warm weather than in the colder seasons of the year. The prostration of the disease, supervening upon the prostration from the heat and the neglect of food, adds a crushing weight to the body and carries it down.

Recently the writer was called to attend a case where the man had eaten nothing for a week, and had been without sleep for five days. His pulse was small, feeble, and rapid like one near death from other causes of exhaustion. He could not bear nourishment, ejecting a teaspoonful of milk instantly. Food was given by enema, combined with other agents, to strengthen the heart and control sleep, till his stomach became retentive of bland foods. No more alcohol was given. Delirium tremens occurs generally in persons in the prime of life—twenty-five to forty years—and one case is found in females to twenty-five in males, which is not due so much to

the difference in constitutions as to the habits of the sexes. On an average, one in five die.

There is an error in the older medical books which still has place in some professional minds as well as among the laity. It is that the sudden withdrawal of spirit from hard drinkers is liable to cause the disease. It assumes that liquor is strengthening, and if taken away, the person drops into the deliriums. We know to the contrary—the liquor has been depressing him, and its continuance is against the philosophy of the deliriums. Alcohol is the top dog in the case and should be taken off. It is the direct poisoning by the spirit, and not the indirect, that produces the delirium tremens. Not a single case occurred in the almshouse in Boston under the care of Dr. Walter Channing, though the alcohol was at once cut off on entrance there. Dr. Albert Day, of the Washingtonian Home, follows the same practice, and so do others. Dr. N. S. Lincoln, of Washington, "never knew delirium tremens to follow complete and sudden stoppage of stimulants."

That many cases of delirium tremens do occur at or near the time when the alcohol is withdrawn is true. But they either ceased to drink of their own accord, because the system being saturated with the poison could hold no more, or the liquor was withheld from them just at the time they were ready to lapse into the disease. In either case, they would have had the tremens all the same had the liquor been continued. To continue the alcohol dosing or to resort to it for the treatment of the tremens is most unreasonable and unwarrantable. Being already poisoned, why give them more? Who would risk his reputation by giving opium or arsenic to cases of opium or arsenic poisoning? Why, then, continue to give alcohol to those already overdosed with it?

Not long since a friend of mine, a man of iron constitution, broke down his brain, brought on epilepsy, delirium tremens, convulsions, apoplexy, and death. Many hundreds die this way every year, and, heedless of consequences, others follow to do as they did.

Delirium tremens, like the former disease, ranges through all shades of severity. Most persons regain a fair condition of health if they discard the bane. Some only partly recover. Many pass from the sphere of human accountability into that condition which here follows, worse than death.

(4) *Dethronement of Reason.*—That many cases of insanity follow the use of strong drink is natural, when we consider the delicate structure of the brain, its vessels, and its vascular envelopes, and the effects of alcohol upon their nutrition and functions. Ding, goes the gong! "Come quick, Doctor! A man has cut his throat!"

Such was the summons I received while penning this last line; and what an emphasis does it put upon these simple statements! What a sight! A man weltering in his blood with his throat slashed from ear to ear; his wife and children appalled. What is the cause? *Drink.*

A person in previous good health, in the prime of life, with a happy home, doing a good business, began on beer, lost his business, squandered years of savings, wrecked himself and the hearts and comforts of his family, and then put a knife to his own throat because made mad with drink. And what a comment is this on the thoughts I am here recording for humanity!

Since I so suddenly dropped my pen, I have been called to another wreck which this fatal ocean has thrown upon the beach. And, like the sad intelligence to Job, comes still another event—the death of

the young man formerly referred to, who was made sick and so killed by one drunk. The real cause of his death will not be known to his parents, neither will the physician's certificate say: "*Dead from one drunk.*" But we know the case, and know this is true.

Having composed myself after this terrible episode, I go on with my sober statement of these most sober facts.

Whether the real cause of insanity is always apparent or not, all medical and medico-legal writers agree that alcohol ranks very high as an agent in its production. But to facts rather than assertions.

It being impossible to obtain statistics from general practice, I must content myself with figures drawn from reports of public and private hospitals where such cases are treated.

On a moment's reflection, it is apparent that such figures must not be regarded as very exact, for the reason that the disease, generally, being chronic, there has been chance for various contingencies to operate, so that in time the real cause is in danger of being overlooked, while the more recent, though trifling, circumstance gets the credit. Besides, the physician is likely to be a stranger, and compelled to take what is told him by strangers, while if friends represent the case, there is a strong temptation to conceal the real cause, and especially if it be drink. To all this must be added the fact that if any prominent secondary cause presents, the primary is not likely to be recognized. To illustrate: If one or both of the parents be drunken, their offspring may come into the world with *inherited* inclination to this disease, and in after life may be in the mad-house, while over against their name is written: "Inherited;" nature, not alcohol, being charged with the account. Thus,

what was but a *temporary insanity of appetite* in the parents now becomes *insanity in the constitution* of the children. Again, the damaging effects of alcohol on a delicate or a predisposing constitution may awaken the latent fires which had else slumbered on. Thus, from the very nature of the circumstances of the disease, truth requires a large addition to the proportion of cases usually referred to alcohol as the cause.

Taking the figures of asylums, we find Dr. Macnish, of the Richmond Hospital, Dublin, setting down *one-half* of the cases under his care as due to drinking. One asylum in the east of London gave 41 per cent. to the same cause; to which may be added a portion of the 22 per cent. of the cases which were attributed to other vices. Nine Provincial private asylums gave upwards of 32 per cent. In 1847, Aberdeen Lunatic Asylum reported about 20 per cent., and Dundee 16 and upwards. During seven years ending with 1846, the Glasgow Lunatic Asylum reported 1900 cases of *lunacy*, with 19.7 per cent., attributable to intemperance. In the year 1844, the Metropolitan Commissioners of Lunacy went over the tables of ninety-eight asylums in England and Wales and found that out of 12,007 cases, whose supposed cause was stated, about 15 per cent. were traceable to the use of intoxicating drink, while 4.6 per cent. more were put down under the head of vice and sensuality, many of which should have been put to the account of alcohol. Out of 2526, headed "Hereditary predisposition," 3187 "bodily disorder," and 2969 "moral causes," large numbers must be credited to alcohol. These counts, all cleared up and rendered, would give from 25 to 50 per cent. to this cause. From these figures the case stands strong against strong drink. But the increase which this form of disease

is making is in exact proportion to the increase in this habit.

Dr. F. Winslow states not only are diseases of the brain and nervous system more common than formerly, but the type of brain affections grows worse. It is characterized as: (1) Insidious in its approach. (2) Tending to that form of insanity which terminates by suicide. (3) Leads at an early age to softening of the brain, when the intellect ought to be in a vigorous and active condition.

Now this type of brain disorder just accords with the known effects of alcohol on the sensitive organism, and tallies with the statement in the United States census report for 1860, after canvassing the whole field, that "the use of intoxicating liquors is a very great source of mental derangement."

Dr. Flint, in his "Principles and Practice of Medicine," declares that "the deleterious influence of alcohol on the mental, is not less marked than on the physical, powers."

In a communication to the writer from Dr. Harlow, of the Maine Insane Hospital, he said: "In looking over our records of patients admitted since the hospital was opened, I find that the use of alcoholic drinks is assigned as the cause of insanity, direct, in about 8 per cent. of all cases, and in about 10 per cent. it has operated as an indirect cause—such as intemperate parents, drunken husbands causing insane wives," etc. And this in a State where comparatively little liquor is used.

Another important statement by this candid authority should be particularly impressed, showing how fair-faced, deceiving, and treacherous is this thing:

"*It is quite a frequent occurrence to have patients brought in to us, between the ages of fifty and seventy,*

who in early life were given to the use of alcoholic drinks, but had reformed and lived temperate lives ten, twenty, or thirty years prior to the appearance of their malady, showing conclusively, to my mind, that the alcohol taken thus early left a damaged brain doubly susceptible to mental derangement."

In confirmation of this I have in mind a large circle of relatives of excellent constitution, none of whom, but one, have ever been accustomed to drink, and none of them were ever crazy. That one drank when in the prime of life, and afterwards thoroughly reformed and lived a remarkably steady and industrious life, till declining years came on. He is now in the asylum with the same looks in his face, with the same motions and actions of body, and the same wanderings and hallucinations of mind reproduced in him as when he used to be drunk. These symptoms are painful reminders of the past.

"The brain and nervous system of men," says Dr. Harlow, "when acted upon, for a considerable length of time by alcoholic drinks, by narcotics, as tobacco, opium, chloroform, chloral hydrate, or any of the nerve stimulants, are pretty certain to give forth uncertain and unreliable mental manifestations which soon ripen into unmistakable disease—insanity."

Surely words like these, from a physician of such experience and candor, ought to rally the friends of the "Maine Law" everywhere to confront such a monster as that which so terribly bombards the citidal of the man.

I have already said enough to gain my point, since the facts I have stated accord with the facts in every land; and no physician of intelligence dares deny them, even though he himself be a slave to the cup. But lest some honest enquirer be still stumbling, because the beam of a liquor-using physician may be

in his eye, I will supplement this array with further citations.

Dr. Walker, of the Insane Hospital, South Boston, and Dr. Eastman, of the Lunatic Hospital at Worcester, both assured the writer of the unreliable character of hospital reports on the causes of this malady. But a wide range of such statements must bring us to an approximation of the truth.

Dr. T. W. Fisher, of the Boston Hospital for the Insane, assures the writer that alcohol acts more potently to make the children of those who drink crazy than themselves, which agrees with the assertions of Dr. Arthur Mitchell, of Scotland. This being true, there is a much larger class to be tabled to alcohol than usually supposed. Hence, we understand Dr. Eastman when he states that "alcohol is doubtless a very prolific cause of insanity, direct and remote."

It is stated that there are cases which take to drink because they are insane; but, at most, the number must be few as compared with those who first make themselves insane by drink and then go on drinking in consequence.

Lord Shaftesbury, in his evidences before the Select Committee on Lunatics, in 1859, expressed his opinon that 50 per cent. of the insane admitted into English asylums owed the cause of their mental state to intemperance, and quoted the authority of Esquirol in support of the statement.

Dr. Clouston, for the cases admitted from Cumberland and Westmoreland, gives 16.15 per cent. for both sexes, and 25.50 for the men alone. Dr. Kirkbride, for thirty-one years prior to 1871, gives 22.52 per cent. for the males in his institution. Out of sixteen American asylums, to the year 1868, including 14,941 cases of all kinds and both sexes, Dr. Lee

gives 11.97 per cent. to alcoholic drinks. Dr. Earle, of Northampton Asylum, puts down 11 per cent. of both sexes, and 20 per cent. to men alone, which is probably about the proportion of Dr. Lee's males.

In March, 1876, Dr. Maudsley showed at a medical conference on alcohol that the large increase in pauper insanity was due to drink, and that strikes and other agencies which lessen wages also lessen this insanity in a marked degree by lessening the amount of alcohol drank.

Turning to France, whose wine habits this country is ured to adopt, Dr. Morel, of Mareville Lunatic Asylum, states: "There is always a number of hopeless paralytic and other insane persons in our hospitals whose disease is due to no other cause than the abuse of alcoholic liquors. In 1000 upon whom I have made special observation, not less than 200 (20 per cent.) owed their mental disorder to no other cause. In many country districts strong liquors are being increasingly consumed, and with a proportionate amount of alcoholic insanity."

Dr. Contesse, Superintendent of the Bicêtre, near Paris, states "that over 25 per cent. of the cases received are due to alcoholic drinking."

Another French physician, Behics, reporting on the physical causes of insanity in that country, puts down 34 per cent. of the 8800 *lunatics* to alcoholic liquors.

Studying the various forms of alcoholic beverages and their effects in the production of insanity, M. Lunier, in 1872, came to the following conclusions, published in the *Annales Médico-Psychologiques:*

1. Spirituous liquors, and especially those manufactured with spirit derived from beet-root and grain, tend, in all parts of France, to take the place of wine and cider.

2. While the consumption of alcohol has nearly doubled between 1849 and 1869—twenty years—the cases of insanity from intemperance, have risen 59 per cent. with men and 52 per cent. with women.

3. In those departments which do not cultivate wine or cider, but alcohol alone, the consumption has gained 75 per cent., and the cases of insanity from this cause have increased in men from 9.72–22.30 per cent., and from 2.77–4.14 among women.

4. Where neither wine nor alcohol, but cider alone, is produced, and where the consumption of alcohol gained 60 per cent., the proportion of cases of alcoholic insanity attained 28.53 per cent. for men, and 9.18 for women.

M. Lunier states that the *alcohol from cider is more pernicious than that from beet-root or grain;* that in the Department of Calvados great deal of alcohol from cider is produced and consumed; that here the rate of insanity is great, and the per cent. of cases from cider alcohol is 56 among men, and 10 among women; that the relative increase of insanity among women, who were previously almost exempt from it, has increased fearfully, and that in Brittany and Normandy excess in drinking alcohol among women has become nearly as common as it is among men. In the Somme, on the contrary, where there has been little increase in the alcoholic consumption, insanity has increased but little.

5. In the same department, where the people drink relatively much *white wine*, very slightly alcoholized, and little spirit, as in the Vendee, Loire-Inférieure, Cote d'Or, alcoholic insanity appears to be as common as in those in which they mainly consume alcohol; though insanity is rare among females. M. Lunier shows that these *white wines* are almost as pernicious as spirit from beet-root or grain.

6. The increase in the number of suicides has everywhere in France followed the increased consumption of alcohol.

7. According to the foregoing, the pernicious effects of alcoholic drinks in producing insanity, rank in the following order: alcohol from cider, alcohol from beet-root and grain, cider, wine, beer; the white wine being much more intoxicating than red wine.

Who can wonder at this terrible result when M. de Pressensé shows that the dram-shops of Paris are 30,000, and in the Provinces 400,000—in all, 430,000, or 1 for 94 of the total inhabitants of France.

Dr. D. H. Tuke, in "Manual of Psychological Medicine," states that "insanity induced by intemperance is unfavorable, and, when it does not assume an incurable form, manifests a strong tendency to relapse after recovery."

Nor is Germany a whit better off.

Dr. Romberg, of Berlin, having passed an army of 50,000 of his insane countrymen under his eyes, speaks thus: "The diseased condition of the blood and its vessels exerts an undoubted influence on the mind. The affections of the brain, such as vertigo, dizziness, fear, terror, etc., are caused in a great measure by the continued use of spirituous liquors and other narcotics, that influence the blood-vessels of these parts. So, after a time, the mind becomes clouded, and sopor (drowsiness), paralysis and death supervene."

Casper, a great statistician, puts down one-third of the insanes of Berlin to spirits.

In Belgium the consumption of spirits increased 66 per cent. from 1851 to 1881; and in 1880 the country had one public house to every 12 to 13 of its grown-up males. In 1848 there were 54 suicides to 1,000,000 of the population, and in 1880, 80. In the same time insanity had doubled. According to the Inspector-

General of Prisons four-fifths of the crime and social misery were directly due to intemperance.

Dipsomania.—There is one *special form* of *insanity* which deserves our pity and makes for prohibition with all its might. I refer to *dipsomania* (the thirst mania), or *oinomania* (wine mania), known among the Germans as *Trunksucht.*

It is a species of insanity of frequent occurrence, intermittent in its attacks, having longer or shorter intervals of apparent perfect sanity. Dr. Stewart, detailing the different forms of insanity observed in the Chrichton Institution, puts this form down as caused by inherited tendency in 63.9 per cent. of the cases.

A physician, himself a subject of this frightful disease, observes as follows:

"It comes from remote recesses." "The tainted blood of many generations has accumulated in his frame to a vast destroying flood." "Like the gathering force of the avalanche, this inherent germ grows and accumulates, and when it precipitates itself upon the blooming valley of his life, buries it in the debris of its wrath." "In my professional experience I have often seen the incipiency of this tempest." "When we better understand it, it will seem to project physiological shadows long before the coming of its dread event."

The grand characteristic of this disease is the *irresistible impulse* by which the dipsomaniac is impelled to gratify his propensity, at whatever hazzard.

This form of mental disorder is to be discriminated from a merely physiological condition, *i. e.*, a condition in which the individual *chooses* to get drunk.

Dr. Tuke remarks: "On the one hand, the admission of this disease into the department of mental pathology does not need to make us conclude that there is no such thing as intemperance without disease; and,

on the other, the fact that the abuse of alcoholic drinks has, often-times, no disease to plead in its excuse, must not lead us into the opposite extreme of denying that a truly diseased cerebral condition may exist, the result of which is inebriety."

There are, therefore, two conditions with intemperance alike in both. But "the prominent feature of this propensity is its *irresistibility;* the thirst for drink is the tyrant which overbears all the higher emotions, and *blindly leads the oinomaniac to a course against* which *his reason and his conscience alike rebel.*"

Dr. Skae has indicated, in his Report for 1872, that the paroxysms of this disease are generally preceded by a general perturbation of the system. "He perspires; the pulse is soft, but quick. He is sleepless, uneasy, prostrate, and so craves a stimulant. Between his attacks he differs from a mere sot in often positively disliking beer or spirits, and is a useful member of society. It is true, however, that the drunkard may become a dipsomaniac, and a dipsomaniac be so injured by drink that he sinks, at last, into a condition nearly resembling in appearance that of the ordinary drunkard, and the broken-down aspect, the feeble, tremulous limbs, the pale or leaden-colored visage, watery and lustreless eye, the deadened affections of the heart, the loss of truthfulness, the weakened intelligence, the dangerous irritability, are common as to both."

As to cure, the chances are unfavorable. When chronic, it is a most intractable disease. Dr. Hutchison says he has seen only one case completely cured, and in this case a seclusion of two years was required. He remarks "that such unfortunate individuals are sane only when confined in an asylum," and this, too, for a long time.

On the basis of this idea numerous hospitals or

"homes" for the cure of inebriety, mostly of a private character, have recently sprung up in nearly all Christian lands, of which, at this writing, there are more than five hundred.

It is surprising how trifling a cause may set off the slumbering magazine in this disease.

An acquaintance of the writer—a man of intelligence, proud spirit, great will-power, and great business capacity—was afflicted with this demon. He was a good citizen, a radical prohibitionist. After a certain defeat of a prohibitionary movement in which he was interested, he cried like a child, and said: "*Why could not my neighbors have helped me put this thing beyond my reach? I am all right when I cannot get it; but there are spells which come over me I cannot control; they are stronger than myself, and if the thing is where I can get it I am cursed.*"

He experienced religion and became humble and happy as a child, and active in promoting the cause of the church. But on one occasion, when he was feeling ill, his wife, unguardedly, gave him a drink of weak cider. It roused the lion in him. He told her she had done wrong, and by no means to give him any more. The fiend in him was pitted against the man's whole better nature. He begged for the cider; for stronger drink. When lucid intervals came he asked if they had given him any, and thanked them they had not. He charged them not to give him a drop, whatever he might do or say, and, if he must die, let him die a sober man. Then the appetite would rage, and a most piteous begging, crying and pleading for the drink succeed. His neighbors and church friends came to his relief and watched with him, held him, prayed for him, and joined all they knew to help him out; and, after a week's struggle, night and day, a final calm came. Never was

there a happier man, nor one more thankful than he that he had gained the victory. I shudder when I think of the struggle of this "strong man is his agony," and it puts meaning to those tears wheu he said: "My neighbors know my weakness, and why did they not help put the thing beyond my reach."

Drunkenness is itself a species of insanity, presenting, as it does, an impairment and irregularity of the mental function, largely referable to congestion of the membranes of the brain; but the form in which the intoxicant is taken determins, in some degree, the character of the mental state. Cider produces the ugliest drunks. According to Dr. Bucknill: "The sottish, swinish drunkenness of an English ploughman, with his stomach full of sour beer, is quite a different thing from the mad inebriations of an excitable Frenchman on fire with *eau de vie.* In the former, the drunkenness consists more in a partial palsy of the muscles and oppression of the brain, than in anything deserving the name of excitement. In the latter, exalted and perverted sensation, flighty imagination, blind passion, giving way to maudlin sentiment, a general and violent stimulation of the mental faculties, are the obvious characteristics of the condition; and they so closely resemble the phenomena of insanity, that while they last they may be said to be almost identical therewith."

The subject of the insanity of inebriates is so full of interest that I cannot leave it till I add the answer of Dr. W. W. Godding, Superintendent of the Government Hospital for the Insane, at Washington, D. C., which he gives to his own question: "What shall be done with them?" It may be suggestive to some other physician: "As scientists, curious of the bacillus, we forget the worm of the still.

As *savants*, we show a pardonable enthusiasm over the shards of a jug on which we may, with laborious pains, decipher the symbol of Annubis or Osiris, but manifest an inexcusable indifference to that human 'treasure' which we have in these frailer than 'earthen vessels,' on whose shattered fragments we might still trace the lines of the image once stamped there. It is time that the scientist and the scholar spoke; that he turn from the contemplation of cliff-dwellings and bone caves, and draw out from dens of infamy and caverns of despair, where he has been hiding, this troglodyte of our time. When the medical men of the community move in earnest in this we shall have public sentiment, and out of that sentiment will come law and an answer to the prayer, 'Lord, that I might be healed.'"

(5.) *Epilepsy.* — Epilepsy occurs as a result of a complex, morbid, nervous state; in other words, it is "a disease of the whole man."

Dr. Todd conceived the idea that it depended upon a blood-poisoning; that the peculiar features of an epileptic seizure are due to the gradual accumulation of a morbid material in the blood until it reaches such an amount as to operate upon the brain in an explosive manner.

The influence of this morbid matter, he supposes, excites a highly-polarized state of the brain, or of certain parts of it, and these discharge their nervous power upon certain other parts of the cerebrospinal centre in such a way as to give rise to the phenomena of the fit.

Prevost and Dumas excised the kidneys of animals and found that as urea accumulated in the system it threw them into convulsions and coma. So, when the functions of these organs is interfered with, as by a gravid uterus, stone in the kidneys, or by Bright's

disease, which changes their structure, the ureal poison not being carried off, fits are the common consequence. Thus, there is a clear connection between deficient renal action and epileptic seizures.

Observers show that the presence of alcohol in the blood checks not only the excretion of carbonic acid from the lungs, but also urea from the kidneys. So that, according to Dr. Todd's ideas, alcohol causes the cause of the fits. But whether alcohol acts specially as the direct or indirect cause of epilepsy, Dr. Flint says: "It is certain that intemperance may give rise to it. Epileptic paroxysms occur not infrequently in drunkards, and cease to recur in cases in which reformation of intemperate habits is effected."

Dr. Drouet collected a large series of cases of this disease occurring in drunkards, in whom no other cause could be found. Of 442 drunkards among men, 45 were found to be epileptic; of 87 women, 9 had epilepsy. Under the age of thirty, 1 out of 15 had the disease, while from thirty to fifty the average was 1 out of 8.

In the experience of Dr. Graham Balfour among the soldiers in the Guards, the fits, with one exception, seemed due to gorging the stomach, usually with beer. He became so positive as to this relation that, when called to cases of fits, he first dislodged the contents of the stomach, usually with prompt relief. Where persons are predisposed to epilepsy, Dr. Carpenter considers the excessive use of fermented liquors to be frequently the immediate or exciting cause of the paroxysm.

Whatever, therefore, strongly disturbs the cerebral functions may prove the exciting cause of epilepsy; and especially is this the case with alcohol, since it depresses while it excites, and, like epilepsy, brings about a depreciation of nervous power, manifested in a decline of muscular and mental energy.

For the restoration of such cases nothing can be done while they continue to drink. The emphatic statement of Dr. Gelineaux is that: "A drinking epileptic will never recover."

V. STRUCTURAL DISEASES OF THE CEREBROSPINAL SYSTEM FROM DRINK.

(1) *Inflammation of the investing membranes*, technically termed *meningitis*—cerebral, spinal, or cerebrospinal as the seat may be.

When following the experiments of Claude Bernard and others on the action of alcohol on the brain of animals, after a portion of the skull had been removed, we saw that the vessels became swollen, congested, pushing the brain and its coverings into the opening. This effect on the capillary vessels is what we witness on the face when thickening, blotches and blains result.

It wants no argument, then, to show that such condition of the capillaries and vessels powerfully favors inflammation, which disease is most common at the age, and with that sex most given to drink. Indeed, one indulgence may produce inflammation in the head, as well as in the liver or other parts. Says Dr. Aitken: "Intemperance is a frequent cause of the chronic forms of the disease; but the free use of alcoholic liquors is, perhaps, the most common predisposing cause; while fits of intemperance occasionally are the direct cause." It is also especially apt to be associated with or follow *delirium tremens*, particularly in the aged.

Two different cases came under my care at the same time, one knocked down by an iron bolt falling on the head, the other knocked over by a blow within by a dose of brandy taken for pain in the stomach. Both persons lost their wits for a time. Both had

pain in the head; vomited; had vertigo on attempting to walk; were weak, and required several weeks for recovery. Both gave great anxiety lest inflammation set in.

(2) *Cerebritis or Inflammation of the Substance of the Brain Leading to Softening and Abscess.*—The principles suggested in the last disease apply with full force here, and no good physician will rebel at the statement of Dr. Aitken when he says: "Intemperance in alcoholic fluids is a frequent cause of this, as well as of every other disease of the brain."

Dr. Rostan maintained that *white softening* may occur without inflammation, which others admit.

Dr. G. B. Wood states that "we can readily conceive of softening as the result of a depraved nutrition, which in its turn may be owing to defects in the blood; and the phenomenon has been observed especially in anæmic persons." How exactly does this correspond with what we have seen of the physiology of alcohol in the blood in depreciating its quality and nutritive work? Moreover, alcohol being a frequent cause of acute rheumatism, indirectly, causes thickening and growths on the interior of the heart and vessels, which in the end get loose and are sent forward as plugs—*emboli*—to the vessels of the brain with their consequent damage.

A few years ago, reports came of numerous cases of sun-stroke in St. Louis, nearly all the cases being in free drinkers, which fact coming to the knowledge of the people, there was immediate decline in the sales, especially of the stronger kinds.

Instead of softening, *induration* takes place, the brain becoming shrunken and hard, a fact which Dr. Peters, of New York, conclusively showed. In these cases alcohol does with the brain in the body just what it or nitric acid will do for brain and nerve-

matter outside of the body. I myself removed the brain of a drinking woman which was much more firm than that of a man taken out at the same time. Alcohol affects the spinal cord just the same.

But lest I appear to assert too much from my own knowledge, I introduce Dr. Samuel Wilks, of Guy's Hospital, as he talked to the students of that hospital on

(3) *The Drunkard's or Alcoholic Paraplegia.*—This is a paralysis of the lower half of the body and not at all uncommon.

Said Dr. Wilks: "I do not know that this disease is deserving of a distinct name from its possessing any pathological peculiarities; but as arising in connection with a very well-marked existing cause, it may deserve special attention, and I refer to it the more especially because I believe authors have generally overlooked it.

"I have already told you that long-continued habits of intemperance in alcoholic drinks tend to the production of a fibrous or fatty degeneration of the various tissues of the body, and that, as a consequence, the membranes of the brain and spinal cord become thickened, and the organs within wasted. This, of course, would give rise to what might be called a general paralysis of body and mind. But besides these general results, we often meet with more direct effects on the spinal cord, and to these particularly I refer.

"I have now seen so many persons, especially ladies, who have entirely given themselves up to the pleasures of brandy-drinking, and who have been rendered paraplegic, that I have become pretty familiar with the symptoms. Of course, drunkards of all descriptions suffer from nervous and muscular weakness; but, as I before said, it is more especially in the legs

that the effect is most striking. A loss of power is first observed, accompanied by pains in the limbs, which might indicate a chronic meningitis of the spinal cord, and in some cases anæsthesia. There is, at the same time, some amount of feebleness of other parts of the body as well as of the mind, and thus an approach to general paralysis is produced; but sometimes the symptoms are almost confined to the legs, and resemble in character those of locomotor ataxy.

"I would repeat that something more definite is intended by the term 'alcoholic paralysis' than that general muscular and nervous debility which is as well known to the public as to the profession; for no character is more easily recognized on the stage of the theatre than the victim of chronic drunkenness. That which I wish more particularly to draw attention to, is the case where alcohol is seen exerting its influence more directly on the spinal cord, making paralysis the leading symptom. Although there is a tendency to a particular form of degeneration in alcoholism, it is not very evident why one person should be affected in one way and another in another. As regards the brain, the tissue degenerates and the membranes become thickened, and thus the mental condition of the 'brainless sot' is familiar to all. In alcoholic paraplegia, there is every reason to believe that the spinal cord is affected in the same way.

"In nearly all cases the liver has been enlarged; there has been sickness, and all the other usual signs of alcoholism. I alluded in my lecture to the existence of pains in the limbs, from which drunkards often suffer before any marked signs of paralysis have shown themselves.

"Three cases which I have witnessed during the last year have made a great impression upon me. A lady not far from my residence, the unfortunate subject of

alcoholism, and having considerable weakness of the legs, was reduced at length to the utmost stage of prostration by want of food and constant retching. A little brandy was put from time to time between her lips in order, as was hoped, to eke out her existence a little longer. The end apparently approaching, straw was laid down in front of the house, and her children were sent for to take a final farewell, when, after repeated urging on my part, all stimulus was suspended. The sickness soon ceased; the blood became gradually depurated; after a few hours a little food was taken; and in a fortnight's time this lady was sitting at the dinner-table with her family.

"Lately, I have been seeing a tradesman and his wife, both of whom were addicted to intemperate habits, and both, most remarkably, had almost complete paraplegia." Dr. Wilks found nothing could be done till the complete withdrawal of all liquors. clearly demonstrating cause and effect.

Among others who have written on this disease is Dr. W. H. Broadbent, of St. Mary's Hospital, London. It most resembles what is known by physicians as acute ascending paralysis, having an apparently similar condition of the spinal cord, in which there is no discoverable lesion, the disease being a progressive paralysis till death relieves the sufferer by putting a stay on the muscles of respiration. Of all the cases which Dr. Broadbent observed he had no doubt as to the cause, as they were all given to excessive indulgence in strong drink. A singular fact is that nearly all the cases are women, and *pains, particularly pains in the legs*, usually precede the development of the loss of feeling and power. It is not uncommon for the paralysis, which begins in the lower extremities, to advance to the arms and thence to the respiratory system.

Wretched as these cases may be, there is always hope of recovery if the poison be abandoned, in which respect it differs widely from ordinary paralysis it so closely resembles, but which is not due to alcohol.

(4) *Apoplexy.*—This is another of the Great Reaper's sickles. It results from a compression of the brain from within, and is characterized by a sudden stroke which suspends, to a greater or less degree, the will, perception, sensation, and motion. This compression comes from over-fulness of the bloodvessels, as in congestion, or from the escape of blood into the brain from defect of the vascular coats through fatty degeneration. What we have elsewhere seen of the peculiar action of alcohol on the vessels and the brain is sufficient to impress us with the direct tendency of this agent to act both as a cause of congestion and a promoter of the fatty change in the vessels.

When studying the physiology of alcohol we saw how the heart became excited, how the arteries throbbed, the capillaries became red and congested, and how the brain swelled and was forced into the opening made in the bone—all of which is directly towards apoplexy. Persons experience the same pressure in the fulness and tension of the head and temples, and in the obscuration of the higher mental powers after a drink. And herein is a notorious fact, that *though alcohol may excite for a time a portion of the mind, it is always the lower faculties; while the higher, such as the judgment and reason, are always lessened;* so that by this abeyance of the higher powers, the wise and the learned, though they cease not to speak when drunk, they babble as fools; and not infrequently have decrees been issued and armies marched under the authority of this species of stupidity.

We are taught by Dr. Parkes that alcohol "in some persons acts at once as an anæsthetic, lessening the rapidity of impressions, the power of thought, and the perfection of the senses. In other cases it seems to cause increased rapidity of thought, and excites imagination; but even here the power of control over a train of thought is lessened. In no case does it seem to increase accuracy of sight, nor is there any good evidence that it quickens hearing, taste, smell, or touch." But, says Dr. Romberg, "it affects the nerves of the eye so as to make it see sights that do not exist; and the nerves of sound so as to make them hear sounds that do not exist—such as boiling, screeching, hammering, cutting," etc.—facts well illustrated in cases of delirium tremens. Not long since, the writer saw a man counting the women in his room, when his wife only was present. He hallooed at the carpenter and told him he was sawing off the wrong board. A Chicago man, under the effects of liquor, imagined himself a locomotive; thought his head was a cow-catcher, and his arms, driving-wheel pitmans. Going along the street, he saw two policemen ahead, and whistled to them, and hallooed to them to get off the track. As they did not do so, he ran into them with his cow-catcher and knocked them down with his pitmans; getting into the lockup for driving his wild engine on the sidewalk.

When the congestion of the brain is carried still further, the anæsthetic action of the alcohol combines with it, producing a temporary paralysis of the lower parts; perception and feeling are lost, and a state of profound coma supervenes, which closely resembles *apoplexy by congestion*, so that the utmost skill could not distinguish the cases were it not for the odor of the breath and some slight difference in

the breathing. Dr. Watson declares, so far as the cerebral symptoms are concerned, they cannot be distinguished. Many good physicians have been puzzled here; and many such cases have doubtless eventuated in true apoplexy, as shown by the postmortems. The only astonishment is, that the brain can bear such insults so long.

Dr. Anstie finds that "among the most frequent causes of apoplexy, especially in some constitutions, is an intemperate use of fermented liquors—a class of substances which powerfully excites, mainly by inducing paralysis of functions, which allows the evidences of excitement to appear as the prominent phenomena."

Dr. Aitken asserts that "alcohol acts specifically on the heart, and the powers of the heart are often permanently augmented, whilst the coats of the arteries, thickened, thinned, or ulcerated, have their elasticity destroyed, and thus the tendency to hemorrhage in the brain is increased." Dr. Ogston teaches that "the nervous centres present the greatest amount of morbid change; the morbid appearances within the head extending to over 92 per cent." of the cases examined by him. Dr. G. B. Wood puts alcohol into a class of causes by itself, in the production of apoplexy. And in Bordeaux where much wine is used the disease prevails as nowhere else.

The recovery of persons after leaving off liquor, shows the effects of the agent. As an instance in point, we have the case of the celebrated historian, Dr. Adam Ferguson. At sixty years of age he was greatly annoyed by threatening symptoms of apoplexy, and at last had an attack. Dr. Watson described him as a fleshy man, "and though by no means intemperate, *he lived fully*." Under the care of Dr. Black he recovered, and, abandoning his

"full" living, became a strict Pythagorean in his diet, eating nothing but vegetables, and drinking only water and milk. So doing he got rid of all his bad symptoms, and became a marvel for health and labor, and died in full possession of his mental faculties at the age of ninety-three.

Conclusions of Dr. Dickinson.—As a fitting sequel to this Part, I introduce the conclusions of Dr. W. H. Dickinson, of St. George's Hospital, who, in October, 1872, published a lengthy report of one hundred and forty-nine cases of persons who died in that hospital, being users of intoxicating drinks. These cases cover a period of thirty-one years, and are compared with an equal number of deaths in persons who were not drunkards, carefully selected with a view of fair comparison. The full details of the appearances were carefully laid before the Royal Medical and Chirurgical Society, and tabular abstracts of the condition of each organ in the two classes were given.

The general conclusions here following are almost a special summary for me:

"Alcohol causes fatty infiltration and fibroid encroachment; it engenders tubercle, encourages suppuration, and retards healing; it produces untimely atheroma (fatty change in the coats of the arteries), invites hemorrhage, and anticipates age. The most constant fatty change — replacement by oil of the material of epithelial cells and muscular fibres— though probably nearly universal, is most noticeable in the liver, the heart, and the kidney. The fibroid increase occurs about the vascular channels and superficial investments of the viscera, where it causes atrophy, cirrhosis, and granulation. Of this change, the liver has the largest share; the lungs are often similarly but less simply affected, the change being

variously complicated with, or simulative of, tubercle; the kidneys suffer in a remote degree. Alcohol also causes vascular deteriorations, which are akin both to the fatty and the fibroid. Besides tangible atheroma, there are minute changes in the arterial walls, which show themselves by cardiac hypertrophy and cerebral hemorrhage. Drink causes tuberculosis, which is evident not only in the lungs but in every amenable organ. It promotes the suppurative, at the expense of the adhesive, process, as seen in the results of pneumonia, of serous inflammations, and of accidental injuries.

"As to the individual organs, the effect of alcohol upon the nervous system must be looked upon as special, and taken by itself. Apart from changes which, like delirium tremens, are more evident during life than after death, the brain pays a large reckoning in the shape of inflammation, atrophy, and hemorrhage. With regard to the other organs, they are damaged much as they stand in its line of absoption. Next to the stomach the liver suffers by way of cirrhosis and fatty impregnation. Next, the stress falls upon the lungs, taking every shape of phthisis. A large share is also taken by the arterial system, as seen in its results—atheroma, cardiac hypertrophy, and hemorrhage. Lastly, the kidneys, more remotely exposed, have a smaller participation in the common damage of alcoholism. They undergo congestive enlargement, fatty and fibroid change, but they do not suffer commensurately with the bloodvessels, or as frequently as the other viscera."

Thus, as I predicted, do we find that alcohol cleaves those who drink it from head to foot. Surely "it bites like a serpent and stings like an adder."

SUGGESTIVE THOUGHTS.

PROF. BUNGE: "Nothing gives us such a perception of the selfishness of the human heart as an attentive consideration of men's attitude in regard to the alcohol question."

TWO HUNDRED AND FIFTY-FOUR BRITISH PHYSICIANS AND SURGEONS: "Alcohol in all its forms should be prescribed with as much care as any powerful drug. Drinking alcoholic liquors among the working classes of this country is one of the greatest evils of the day." *Eighty-one out of eighty-two Canadian physicians*, by letter, agree that universal abstenance would be a great public benefit.

DR. ALBERT DAY: "The drinking customs of society have developed very strange theories in order to sustain the custom, and in most cases they are the offspring of gross ignorance, or a mind befogged by alcohol. No matter how healthy a man is, if he indulges in alcohol, even moderately, physical and mental degeneration will follow."

PROF. WILLARD PARKER: "Alcohol has no place in the healthy system, but is an irritant poison, producing a diseased condition of body and mind."

PROF. T. L. MASON: "Alcohol is a poison inherently, absolutely, essentially; in a drop or in a gill, in a pint or in a gallon, in all quantities and in every quantity, it is a poison. Its quantity cannot alter its chemical constitution."

PRESIDENT GREEN, of the Connecticut Mutual Life Insurance Company: "The degree to which many diseases commonly referred to as malaria, overwork, and other vague general scapegoat causes, are actually grounded in what would almost invariably be called a temperate use of drink by persons of reputed temperate habits, would be incredible to the mass of people unaccustomed to careful observation and comparison of related cases."

DR. TO. VENNER, Bathe, 1638: "The animall powers defatigated, or otherwise disturbed, may be holpen with a safer, better, and a more godly remedie than by an unquiet and turbulent sleep; for Drunkards verily do not enjoy sweet and quiet sleep whereby the animall powers are truly refreshed."

PART III.

Alcohol Related to the Body as a Poison, a Food, and a Medicine.

HAVING traced alcohol into and through the system to its final elimination (though for the most part insensibly) in the same manner as ether, chloroform, camphor, and other similar substances are eliminated, aud having noted some of its physiological and pathological effects, I come now to point out certain other facts comprehended under this threefold relation.

Section I.—Alcohol as a Poison.

Hippocrates said: "Everything that is made is made by a why, in the presence of which chance loses all its reality." My own mind demands the why of things. Alcohol has its whys, and to point some of them out, in place of the too frequent bald assertions, is the reason for these pages.

Everybody speaks of alcohol as a poison, but why is it a poison? What are the proofs?

Lexicographers have found it hard to give such a definition of the term poison as satisfies medico-legal criticism.

Webster says it is "any agent capable of producing a morbid, noxious, or dangerous effect upon anything endowed with life." Thomas ("Medical Dictionary"), any substance which "operates such a change in the animal economy as to produce disease or death." There is no better definition than that by Dr. R. Dunglison: "A generic name for all substances which when introduced into the animal

economy, either by cutaneous obsorption, respiration, or the digestive canal, act in a noxious manner on the vital properties or the texture of an organ."

As a rule, stimulants and narcotics contain certain active principles, more or less poisonous, which give them their characteristics, and explain why they are sought and used.

After his definition, Dr. Dunglison tabulates the various "noxious" agents; including alcohol—brandy, wine, and all spirituous liquors—under "inorganic poisons." He gives the "symptoms" of its speedy effects—"intoxication, and when taken very freely, complete insensibility, with apoplexy or paralysis of one side; the countenance swollen and of a dark-red color; the breathing difficult and often stertorous, with a peculiar puffing out of the lips; the breath smells of liquor, which distinguishes the symptoms from those of spontaneous apoplexy," except in spontaneous apoplexy supervening on drinking. A sure sign for this distinction, however, is found in pressing the thumbs sharply over the nerves just above the eyes, when the person will start up, unless it be a case of real apoplexy, or he is dying.

For treatment of this poisoning, he directs a powerful emetic of white vitriol or of tartar emetic; and if the person has lost all power of swallowing, a flexible catheter should be used to get the vomit down, its action to be encouraged with warm water, while large clysters of salt and water are to be administered.

That alcohol in large doses is such a poison admits of no question. All medical and medico-legal writers so classify it; and all practitioners become painfully familiar with the fact. It is not, therefore, as an acute, but as a *chronic poison*, we are here to study it. Is it in any form and dose "noxious" to the body?

Does it act in a "noxious manner on the vital properties or the texture of an organ"? The following counts must answer this:

I. ALCOHOL DERANGES THE BLOOD GLOBULES.—NEURALGIAS.

That two and two make four, is not plainer than that an agent which contracts and shrinks these little, active bodies of the blood, as we saw alcohol did (and anybody with a good microscope can demonstrate it), must act in a "noxious manner," and that exactly according to the greater or less amount used. Even small doses will disturb their functions, and so disturb "vital properties."

The common *anæmia of liquor-users* can be explained in this way. So can *neuralgias*, so generally attendant on impoverished blood, and almost invariably made worse by wines and spirituous forms administered for their cure. Like opium, continued, alcohol at length begets the very pains it was at first taken to alleviate. It smothers to foster. Who takes it for comfort needs its comfort more till life is a burden, save only when under its narcotic or anæsthetic power. The fact that it begets an unnatural desire and demand for itself is proof positive that it has changed "vital properties." It has subverted nature and broken the physical chain which links its parts, so that their functions cannot harmonize; and the only way back to physical oneness is to abandon the divider, and employ rational restoratives—as rest, proper quality and quantity of food, and such medical agents as experience has shown to have power to revitalize the blood. To treat simply the pains of anæmic neuralgia is like cutting down a tree at the top.

Dr. Anstie, of London, himself as much a believer

in alcoholic medication as any intelligent physician can well be, upon this subject says: "Nutrition in neuralgic patients is very commonly kept up by slops, and is thus very insufficiently maintained; this failure of nutrition is itself a decidedly powerful influence in aggravating the disease. And there is still further calamity not unlikely to occur: The patient may fly to the stupefaction of drink as a relief to his sufferings; and if he has once experienced the temporary comfort of drunken anæsthesia, is exceedingly likely to repeat the experiment. But *this is another and most fatally certain method of hastening degeneration of the nerve centres, and the ultimate effect thereof is disastrous in every way.*"

The following, by the same author, on the "*function of alcohol in neuralgia*," is decidedly to the point: "Though the agent is a narcotic when given in large doses, it is not under that aspect that I recommend its use in neuralgia at all. I have written so much upon this subject lately that I shall content myself with an emphatic repetition of my protest against the use of alcoholic liquors as direct remedies for pain. I cannot too expressly reprobate the practice of encouraging neuralgics, especially women, to relieve pain and depression by the direct agency of wine or spirits; it is a system fraught with dangers of the gravest kind."

Dr. Evory Kennedy, the eminent president of the Dublin Obstetrical Society, discoursing to that society, November 22, 1873, on the *treatment of female diseases*--disorders so common in these times and so generally anæmic—observes: "I cannot conclude this case, and with it the subject, without dwelling briefly upon the growing practice of administering stimulants too freely in these cases. A very considerable proportion of the cases presenting themselves, both in

single and in married women, are induced to exceed in this respect, and the invariable answer to inquiries is, the doctor ordered them to take plenty of wine; and some even add brandy. My experience in the treatment of this and most other diseases of females, coming under my notice, is that for one that requires stimulants and derives benefit from them, *ten are injured by their use* (many of them irreparably), and the others recover only when stimulants are desisted from."

Dr. J. Matthews Duncan considers that a majority of the cases of *vaginitis* are due to alcoholic indulgence, and that they cannot be cured but by leaving off the indulgence. So of *ovarian pains* and inflammations.

That alcohol *does not produce equally palpable evidence of poisonous effects on all*, argues no more against its poisonous nature than the different effects of opium, arsenic, or lead on different persons. It is known that many inmates may occupy the same house papered by arsenical paper, or drink water from the same lead pipe, and only one or two present evidences of harm. This circumstance does not argue that either is wholesome, nor lessen the common belief that lead and arsenic are poisons.

The *power of a particular constitution* to apparently resist the deleterious action of an agent, cannot be used to justify the wholesomeness of that agent which harms or kills others whose constitutions cannot so well resist it, and especially so when the general tendency of that agent is known to be in the direction of harming and killing, as is the case with alcohol, as shown in the numerous morbid changes mentioned in our Second Part. And though there is occasionally a liquor-user who appears to enjoy good health, and who goes on to "ripe old age," he is no

more to be taken as a proof of the general harmlessness of drink, than is the man who stands in the thick carnage of battle a proof of the general harmlessness of the missiles of war. If such a man should contend that there is nothing to fear from "cold lead" and bursting shells, and should seek to confirm his statements by personal experience, saying: "Behold me!" Would not everybody exclaim: "O, foolish man! look around you?" And when only ten or twenty of the thousand strong, who went with them to the carnage, were all that came out alive with their tattered banner, would not the tears of mothers, sisters, wives, children of the slain plead eloquently for peace and not for war? Behold the tears which alcohol has wrung out of the heart of affection in every land! Plead they not for abstinence and not for indulgence, even though there may be a drinker here and there who does not immediately die? Surely, the general tendency of alcohol is to destroy.

In the *cooler seasons* of the year, when the cold acts as a tonic; when abundant ozone cheers and invigorates the blood; when the appetite is good, and much food is taken and much blood made, so that the system has greater power of resistance, the pernicious effects of alcohol are not so apparent as in summer, when vitality runs lower, digestion is weakened, and less food is taken and less blood made. Surely, it is only a blind prejudice that can construe these circumstances to the more friendly nature of alcohol towards the body in winter than in summer.

Dr. Marcet cites the fact that the ravages of alcohol are much more apparent after the *age of forty-one* than before, for the reason that the constitutional powers have reached their height, and are becoming

less resisting, so that strong drink gains the ascendency in the struggle.

Persons who have *strong constitutions* naturally bear up against it much longer than others. So do those who are engaged in laborious outdoor work whose muscles are large, who have much blood in their system, and who eat heartily and sweat much. On the other hand, persons of weakly constitutions, who eat little, or are reduced by exhausting chronic diseases, soon manifest the pernicious inroads of alcoholic drinks, and most especially those whose blood-making powers are below their normal standard, and whose powers and circumstances of elimination are the worst.

That liquors are bad on *little children*, who have little resistance to morbific influences, is another proof of their general depreciating nature.

The *milk even of a drinking nurse* is prejudicial to infants. The observing Scotch doctor, Macnish, says such children are almost always sickly; subject especially to derangements of the digestive organs, and to convulsive affections. Dr. North has been obliged to discharge such nurses, transferring the children to the breast of abstaining women, with immediate benefit.

The habit in some parts of Scotland of giving raw whisky to babies when but a few days old turns them pallid, causes them to become emaciated, fretful, subject to convulsions, and every variety of disorder of the stomach, with diarrhœa and vomiting, and may end in death.

The *experiments of Dr. Hunter* are significant. He gave to one child a glass of wine and to another of the same age—five years—an orange daily. In a week the wined child was sick; its pulse was raised, the urine high-colored, and the bowel passages destitute of the usual bile. The child having the orange

remained well. Dr. Hunter then reversed his gifts with exactly reversed results. In these experiments the wine both hindered the digestion and injured the blood.

The writer had under care a little girl in a family where all the other children had died soon after birth. The parents were strong, muscular people. Why, then, was this little girl pale, weakly, emaciated, and so often sick? I ascertained that her parents drank beer and gave "the goody" to her. This pernicious habit was stopped and she grew rosy and strong, with a good appetite and a fine double chin. The following is very instructive:

At the *North End Mission*, in this city, there is a Children's Home, into which little waifs are gathered from the lower quarters and hovels of the wretched. Most of them had nursed beer and whisky from their mothers, or were fed on it. Though usually fleshy enough, they are pale, dull, and subject to numerous sicknesses. Coming to the Home, they are washed, cleanly dressed, and put on wholesome fare. Many of them, in common parlance, would be called well nourished. But a singular circumstance takes place after they are fed with good food and the beer is withdrawn. They begin to shrink and emaciate, and this goes on from four to six weeks, showing conclusively that they were poorly organized, and bloated with a flesh which nature had to pull down and throw off before proper healthful processes could set in. After this they gain in solid flesh, grow rosy, active, playful, and happy, with bright eyes and a vigor they never knew before. They were sickly, half-starved children; now they are healthy. This is the uniform result with this class at this Home, and it is a most emphatic example of the deterio-

rating effect of beer on the blood and tissues, while it makes the outward show of flesh and health.

And what is here so unquestionably shown, is true of persons of larger growth who have depended on alcoholics to support and nourish them. While they fancy themselves to be sound and well, they are bloated and diseased, and compare with real soundness as shoddy goods compare with real stock. This bloating of the tissues is a real damage instead of a gain, for when their vital powers become weighed in the balance of strain and wear they are wanting. Thus they are especially exposed to all manner of diseases, and these diseases are exceedingly fatal when they come.

2. *Chronic Alcoholism.*

This is a state of the system which, on the authority of Dr. C. R. Drysdale, of London, is, next to consumption, the most frequent cause of death in Paris and in London. It is insidious, even the most intimate friends do not recognize its approach, while the persons themselves are rarely drunk. This, according to Dr. Magnus Hüss, "applies to the collective symptoms of a disordered condition of the mental, motor, and sensory functions of the nervous system, these symptoms assuming a chronic form, and without this being immediately connected with any of those (organic) changes of the central or peripheric portions of the nervous system which may be detected during life, or discovered after death by ocular inspection; such symptoms, moreover, affecting individuals who have persisted for a considerable length of time in the abuse of alcoholic liquors."

Dr. Marcet says this is a "most distressing form of disease affecting the nervous system, which those unfortunate persons who persist in drinking to excess

seldom escape, and which constitutes a state of prolonged or *chronic poisoning*."

Chronic alcoholism has none of the violent frenzy of acute alcoholism which we have elsewhere described, nor of the excited delirium of the paroxysms of delirium tremens. It is a *state of long and uninterrupted suffering*, allowing the patient no rest day nor night. Though he may see the coming doom and abandon his beverage, he is not unfrequently disappointed in the hope of recovering his health. In the language of Dr. Marcet: "Week after week, month after month, year after year, he patiently waits for the termination of his sufferings, and endeavors to apply the remains of strength to such occupations as will tear him away from his miseries, although usually he finds himself so weak that he is denied even this poor source of relief."

Dr. Meredith Clymer gives the most characteristic symptoms of this disease as follows: "Digestive troubles, tremor, muscular weakness, and restlessness, hallucinations of the intellect and the senses, anæsthesia, hyperæsthesia, lessened and perverted brain functions, and often intercurrent attacks of busy and delusive delirium; later, there may be sensory and motor paralysis, and acute mania and dementia." "These symptoms are due to the direct irritant effect of the poison upon the stomach, and, by its subsequent absorption into the blood, to the gradual impairment of nutrition, resulting in tissue changes, of which the special one is, probably, granulo-fatty degeneration."

The *first disturbances noticed* are those of the digestive organs. On rising in the morning the mouth is parched, the tongue dry and coated, and the breath fetid. There is nausea; a white stringy phlegm, or a greenish or yellowish mucus, is thrown off the

stomach. About this time a series of nervous symptoms sets in. The patient complains of fidgets, and has difficulty in keeping the limbs quiet, particularly at night; wakefulness is annoying, and however drowsy he may be, after a short dozing, awakes and tosses the remainder of the night. After a time there is persistent muscular tremor of the fingers, hands, feet, legs, and tongue. A case under the care of the writer cannot swallow solid food, there is so much trembling in the throat. His countenance is very dusky, with large, dark patches under his sunken eyes. When he falls into a doze his head and mouth are going, he picks at imaginary nails, mutters and talks, and is often started out of his dozing by his frightful dreams. He does not hear readily, and one day spoke to his wife about the many persons he saw in the room when she only was present.

In *confirmed cases*, the tongue gets glazed and fissured; the breath has a peculiar foul odor; the stomach symptoms increase and vomiting becomes constant. The complexion, at first of a violet-red, changes to a dull-white; the face is bloated; and the nose and cheeks frequently break out with red acne; while hemorrhages in great amount sometimes take place from the stomach and bowels. Not unfrequently would the tormented man kill himself if he only could.

According to Dr. V. Magnan, the disease follows two paths. In one direction, it leads to loss of mind, dementia, from fatty degeneration; in the other, it tends to paralysis through diffuse sclerosis or hardening of the nervous centres.

Dr. E. C. Morgan, of Washington, cites some interesting cases of aphony, a paralysis or loss of speech, due to chronic alcoholism.

Prof. Leudet, of Rouen, describes a form of this

disease in which the *spinal cord is especially involved.* It consists in pain varying in intensity, generally deep-seated, now and then superficial; it presents itself at times in the form of a remarkable exaltation of the sensibility of the whole trunk and limbs. At the same time there exists pain along the spinal column, a want of feeling in certain parts of the skin, impaired mobility, weakening of the muscular powers, particularly in the lower limbs, cramps, and a morbid exaltation of reflex movements. They present remarkable variations; and when they cease they are very frequently followed by injured power over the lower extremities.

Dr. Lancereaux has directed attention to the *similarity of the tissual changes of chronic alcoholism and those found in old age.* In both there is progressive atrophy of the brain, increase of the cerebro-spinal fluid, granular and fatty alterations of the smaller vessels in the muscular tissue of the heart, and, indeed, in most of the elementary tissues throughout the body, with dilatation of the pulmonary vessels, fatty change in the bones, etc. Thus, both physiologically and pathologically, alcoholism brings on old age.

According to Dr. Hüss, "the *changes in the relative proportions of the elements of the bloood* are of a marked character. The blood of drunkards is impregnated with a *foreign substance*, and as long as it remains in the blood a certain degree of poisoning of that fluid takes place, which exhibits itself either by direct intoxication, or, in more gradual doses, by certain lesions of the nervous system, which are kept up by a constant supply of the pernicious fluid."

The effects, therefore, of habitual drinking are those of *devitalization, arising from disturbed and imperfect interstitial nutrition.* Says Dr. Anstie: "The

congestion of the lungs, liver, kidneys, etc., seems to be partly due to altered chemical relations between the blood and the tissues of those organs, and partly to a paralytic action of the alcohol upon the vaso-motor nervous system," as well as upon the nerve-centres themselves.

It is also likely, as he suggests, that a starting point of these degenerative tissue changes consists in paralysis of those nervous branches which preside specially over nutrition. However, it is quite certain that a considerable portion of the degenerative influence of the alcohol habit is owing to a chemical interference with the natural course of the oxidation of the blood and tissues; at the same time "the balmy" effects of the etherization on the nerves bewilder their physiological functions.

It is also remarkable how readily intercurrent diseases come on in the course of this greatly disordered condition, and make a finish of the deplorable malady. My own sad case, whose history and symptoms make all I have just written only sober facts, is now, while I write, dying from supervenient lung complication. Poor man! Why did he not heed the pleadings of his devoted wife in the years gone by?

I have had other cases in which the intercurrent diseases acted very differently from what they would have acted had they occurred in non-alcoholized constitutions. It is this *liquor-rotten condition* which causes the diseases to play such a strange rôle. Not only are such persons likely to get sick, but one form of disease is extremely liable to be followed by another through a long series.

The question is pertinent: *How much can one indulge before he reaches such a pass?*

To this, Dr. Marcet, after treating forty-eight cases and furnishing the lessons they taught to the profes-

sion, makes answer: Small amounts will do it—even a pint or two of beer a day will do it. And while some constitutions seem almost proof against poisoning by liquor, he asserts that "these exceptions are but few." At any moment, in such altered conditions, accidental circumstances may fire the combustible compound and set the morbid train into action.

Sir Wm. Gull, M.D., states that "the commonest thing in British society is that people are injured without being drunkards. From my experience, alcohol is the most destructive agent that we are aware of."

Drs. Hüss, Marcet, Clymer, and others agree that the first necessity towards a recovery from this deplorable condition is the entire abandonment of the alcoholic poison; otherwise nothing can cure. That alcohol will keep the man down is a proof positive of its damaging power, to say nothing of the work it has done to bring him down.

A *special form of chronic alcoholism* was witnessed to an unusual degree during the siege of Paris, in the late Franco-Prussian war. It was described by Dr. Galezowski, who saw more than fifty cases of it, as an impairment of vision, technically called *amblyopia*. Its characters are: Vision rapidly weakened, so that a person sees but dimly and not at any great distance; the figure of a man cannot be distinguished unless near by; patients see better in the evening and morning than in the middle of the day; some who could read quite well before rising in the morning could get about only with great difficulty in the daytime; the power to distinguish colors was usually modified, and the disease, like other forms of alcoholic poisoning, though manageable in its first stages, was difficult to remedy after it had become chronic,

and not at all until the poisoning agent was totally removed.

These cases came by the use of alcohol, especially by poorly fed people, where it was taken for a part of the diet.

In such persons, operations on the eyes were very disastrous, often inflaming and suppurating, and slight wounds would be weeks healing.

What is true of the eye is equally true of every other part of the body in alcoholic cases. Both wounds and diseases are apt to work badly; and physicians and surgeons dread to do for persons so changed. Small scratches are liable to take on erysipelas, and suppuration and gangrene follow till death not infrequently brings relief.

That drinking people look plump and, to the common eye, healthy, is no proof of the soundness of their powers. They fail when other men survive. An old man in Maine was knocked down, and his leg, below the knee, crushed to pumice by a falling tree. He lost much blood, and was carried two miles out of the woods on a sled, with nothing to keep him warm, and that on a bitter cold day. The writer amputated his limb close to the knee, and he recovered. A German in Boston, fat and well, getting home from his work on a pleasant evening, drank a mug of beer, was knocked down and his ankle run over by a passing horse-car, and, though his injury was not more than half as severe as the former, he never rallied. What was the difference? Drink. All there was of the old man was native vitality; the young man was rotten with beer.

Thus, exposure to heat and cold, to labor, disease, and accident, weigh the drinking man over against the abstainer, and show how honey-combed he is by his indulgence. So, Dr. Baer, Sanitary Coun-

sellor, at a meeting of scientists and physicians, held in Berlin, September 18, 1886: It is a well-recognized fact that sick drinkers die much sooner than the temperate with the same disease. And Mr. Caine, member of Parliament, who gave much study to statistics on this point, found that total abstainers average above six years of life beyond the moderate users of the light alcoholics—as wines and beer.

Oftentimes drinking people find that they cannot longer take their accustomed beverage; the liquor *disagrees* with them, and they have to give it up. When this comes the friends must not be wholly elated, for there are "breakers ahead"—not a moral, but a physical necessity exists. Dr. Kraft-Ebing urges that it is a sad omen; for such has been the damage to the system that it is a sign of approaching insanity or paralysis. The liquor is not abandoned of choice, as friends so fondly hope, but because nature has rebelled at the outrage. Alcohol has reduced the person to a similar state to that brought about by sun-stroke, in which, as every physician should know, alcohol cannot be borne. Dr. A. L. Loomis, of New York, declares alcohol to be a direct poison in such cases.

As the poisoning goes on and the powers to resist diminish, the *liquor grows more and more enraging*, and, not knowing the import of these things, people attribute them to the more deteriorated liquors of these "degenerate times," and say: "O, if we only could get some of the pure article of other days!" But the fact is not the liquor, but the drinker is changed. He is not what he was, but transformed through and through.

Not long since, the writer was discussing with a mechanic, himself tremulous with drink, whether a a certain bloated gentleman, of forty-nine, would

live the longer—he or his father, then eighty-two. We concluded that the old man would outlive the son, which proved true. When young, the father came to Boston, determined to make "a pile," went for it and got it. His ceaseless activities, temperance, and self-denial kept him "lithe of limb" and in perfect health. The pampered son took a different route—that of ease, indulgence, and the sparkling wine. The processes of elimination were not encouraged by labor (one of the best blessings to man in this life), but, on the contrary, were crowded with work by luxurious living, and the physical wheels obstructed by his alcoholic beverages. Hence the diseased blood, the storing up of fat, the horrid gout, and—the old man burying his only boy.

Both gout and rheumatism have their philosophy in blood changes, such as alcohol induces.

But will a man "burn alive?"

That the breath of persons under the influence of liquor may take fire is quite generaliy believed, and has illustration in what my friend, Mr. Geo. W. Hutchins, of this city, related to me. He had taken a bad cold and had a sore throat, for which he took a stout dose of cherry brandy. About fifteen minutes later he attempted to examine his throat, and brought the light within six or eight inches of his face. Instantly the flame leaped into his mouth and exploded with a decided noise, burning his mouth and scorching his mustache.

Haller relates the case of a hard drinker, suddenly killed by the vapor which he eructated, taking fire from the flames of a candle.

But will alcohol work such a change in the constituents of the organism as to produce a veritable combustibility? If so, the stalwart advocates of cremation may find an easy solution of their problem

by advocating drink. That there is such a possibility many think probable. Sir Henry Marsh saw two consumptives whose faces were luminous. Dr. Henry Miller speaks of the phosphoric odor by times of the skin of drunkards, and mentions that their breath and urine have been seen to glow in the dark.

Sir William Gull mentions a case where a man died of alcohol whose body, enormously distended with hydro-carbon gases, was punctured in twelve or fifteen places, and the escaping gas ignited and burned for some time. Thus, the phosphoric and carbon elements, which should have been oxidized and removed, were staid in their metamorphoses and retained, still mingling with the excessive hydrogen compounds.

In such cases the body, though difficult to burn ordinarily, may become so altered in composition as to catch fire—at least this is the opinion of Vicq d'Azyr, Lair, and Dupuytren. Le Cat, Kopp and Marc think that there is no need even of the candle to set it on fire, as it will take fire spontaneously like a heap of oily woollen rags.

Dr. Bertholle, in the *Union Médicale* of February 15, 1870, relates a case of a drunken woman, of thirty-seven, who caught fire spontaneously and had her bowels burned out, and portions of her limbs destroyed, without burning either her clothes or her hair. The writer knew of a man who was a hanger-on at a liquor store, drinking and begging treats whenever he could. At length, by false swearing and suborned witnesses, he got possession of nearly $1000, and gave reins to his appetite. His health rapidly declined till he was brought to his bed, where he still continued to drink. Being very low one evening, his attendant, approaching him with a lamp, said his breath caught fire, the blaze leaping into his

mouth, upon which he sprang up and uttered a horrid scream, fell back and died in the greatest agony, the flame issuing out of his throat. The statements of this woman found credence among the villagers, some of whom declared it to be "the judgment of God."

3. *Alcohol Depreciates the Natural Prospect of Life.*

Alcohol is further shown to be a poison by its power to curtail the natural prospects of life. This is not so much apparent from a few instances, but when considered over a wide range nothing can be more conclusive.

(1) *Alcohol and Life Insurance.*—As "money makes the mare go," so it sharpens the eyes of those who have a moneyed interest in life insurance. The observations here are most critical, and at once place the question beyond all cavil.

The *Carlisle tables*, so called, are the most precise yet constructed. In these Mr. Milne, of England, calculates as follows:

At	7	the years of expectancy are		51,	or death at		58
"	10	"	"	49,	"	"	59
"	15	"	"	45,	"	"	60
"	20	"	"	41½	"	"	61½
"	25	"	"	38,	"	"	63
"	30	"	"	34½,	"	"	64½
"	35	"	"	31,	"	"	66
"	40	"	"	27¾,	"	"	67¾
"	45	"	"	24½,	"	"	69½
"	50	"	"	21¼,	"	"	71¼
"	55	"	"	17¾,	"	"	72¾
"	60	"	"	14½,	"	"	74½
"	70	"	"	9¼,	"	"	79¼
"	80	"	"	5½,	"	"	85½

At the age of 40 the general rate of mortality in England is 13 to 1000; at 45 to 55 it is 18, though varying considerably on account of business and manner of life.

In the United States the average mortality of all ages is 17 to 1000.

The Registrar-General of England gives the following for the occupations:

Of 1000 farmers	12	died.
" shoemakers	15	"
" blacksmiths, carpenters, tailors, and laborers	17	"
" miners (¼ of these by accident)	20	"
" bakers	21	"
" butchers	23	"
" inn- and beershop-keepers	28	"

The insurance statistics, given by John Scott, show the death-rate of saloon-keepers, as compared with other people, to be of:

Saloon-keepers.		Other people.
Between the ages of 24 and 40,	21 per 1000 die.	10 per 1000
" " " 40 " 60,	60 " "	30 "
		Ministers.
" " " 25 " 35,	14 " "	4 per 1000
" " " 35 " 45,	20 " "	6 "
" " " 45 " 55,	38 " "	13 "

In 1869, Mr. John Rutherford stated the following: A certain assurance office with which he was connected issued 30,000 policies to moderate drinkers, and 10,000 to teetotalers, excluding all publicans, brewers, and free-drinkers, and the mortality of the two classes was kept separate. During the first thirty years the mortality of the teetotalers was 19 per cent. less than that of the moderate drinkers; while for the last eight years it has been 25 per cent. less.

In 1886, the Total Abstinence Department of the Sceptre Life Association of England had at risk 3901 lives, of whom only 14 died, being less than 4 to 1000. During the last twenty-one years this Association should have lost 361, but as a matter of fact only 162 died—less than one-half the usual death-rate where drinkers are insured.

The policies issued by four of the principal English

assurance offices for their first five years amounted to 6153. Of those assured, 117 died, being nearly 20 to 1000. During the same time the United Kingdom and General Provident Institution, which excluded all drinkers, issued 1596 policies, and had 12 deaths, or 7½ to 1000.

So evident is this fact, and so certain are innkeepers to indulge in the use of liquors themselves, that it is customary to charge 10 to 20 per cent. extra on their premiums, while no respectable society will insure drunkards at any rate, and if any of their policy-holders become drunkards, they cancel their policies as soon as possible. Not long since such a case importuned the writer to help him back. Indeed, so important is this question that the examining physician is under the necessity of guarding against every conceivable ruse on the part of the applicant, whether male or female, to get out a policy and yet indulge. And so great is the mortality of the so-called "temperate" class over the total abstainer, that no man who is a teetotaler should insure in a company which insures them, unless entirely different books are kept.

Dr. E. H. Sieveking, in his *Medical Adviser in Life Assurance*, says: "The difficulty that we have to deal with consists in the very great *latitude in the definition of intemperance.* But for the purpose of life insurance the broad line may be laid down, that the habitual spirit drinker, and especially one who is found to take strong drink early in the day, ought to be declined altogether. There is scarcely a degenerative condition of the body that may not result from the abuse or rather use of ardent spirits."

The late Ale and Porter Brewer's Association found difficulty in adopting a rule limiting the apprentices to one to twenty-five of the experienced hands, be-

cause it was claimed by many that the men died off too fast.

Mr. Thomann, of United States Brewer's Association, in the interest of beer drinking, claimed that beer drinkers were healthy. This brought out the following from an old medical examiner, Dr. Bombaugh, who said he had "closely watched the heavy beer drinkers in the community, with reference to their mortality-rate for more than twenty years, and our observations show that *out of every hundred who saturate themselves in this immoderate way, not more than five pass the age of fifty-three.* Those that escape Bright's disease or uræmic poisoning become victims of cirrhosis, or fatty degeneration, or erysipelas, or apoplexy. One or other of these fatal diseases invariably gives the finishing touch to the 'splendid physique' long before the period of natural exhaustion."

But this is by no means the whole story. *A man has reformed and become a teetotaler.* Does this bring back his lost energy and restore his physical integrity? By no means. He has no such prospects of life as he would have had but for strong drink.

On coming into the world one may expect to see 38¾ years. At 5 years, the most critical period being passed, one's expectancy is 51¼ years, which added to the 5 already lived offers a prospective age of 56¼.

So Dr. Brinton: "*The reformed drunkard is not a good life;* his repentence, as regards his physical constitution, often comes too late. Many months or even years of the most complete abstinence scarcely suffices to restore his probabilities of existence to a level with those of the temperate user of alcohol. Setting aside the not-inconsiderable chances of his relapsing into old habits, his constitution often seems to have a peculiarly treacherous character; its ap-

parently robust health consuming away with unusual rapidity under a moderately severe attack of any acute disease."

According to Mr. Neison's careful showing, the effects of intemperance exhibit themselves chiefly at a comparatively early age. The great majority of the cases of delirium tremens which terminate fatally are between twenty-five and thirty-five years, while the maximum mortality of intemperate persons is between forty and fifty; and persons, who at that age give evidence of habitual temperance, are most likely to continue to do so, and they have escaped one of the most prevalent causes of degeneration of the tissues.

Mr. Neison shows that where ten abstainers die between fifteen and twenty years of age, eighteen intemperate persons die; between twenty-one and thirty years fifty-one intemperate, and between thirty-one and forty years, forty intemperate persons die, or on an average of thirty-six intemperate to ten abstainers from fifteen to forty years of age.

The figures we have given show that those who have arrived at the age of fifteen, and from that to fifty, have reason to expect to live to see the age of sixty to seventy-one and a quarter years. Now, when we compare these figures with those which Mr. Neison gives—the period at which the great majority of the intemperate die—we can form some idea of the havoc which liquor makes with man's allotted years.

Mr. Neison has also constructed another table, further showing the difference between the results of temperance and intemperance. The calculations are based on 357 individual lives, and embraces a total of 6111½ years. Though these numbers are too few for perfect accuracy, they are sufficient to make a fair exhibit of the important truth they teach.

At the age of	20	the expectancy of the temperate is			44.2 ;	of the intemperate,			15.6	years.
"	"	30	"	"	"	36.5 ;	"	"	13.8	"
"	"	40	"	"	"	28.8 ;	"	"	11.6	"
"	"	50	"	"	"	21.25 ;	"	"	10.8	"
"	"	60	"	"	"	14.285 ;	"	"	8.9	"

Lacking exact figures of comparison between these and the total abstainer, I introduce Dr. Munroe, of Hull, England, who speaks thus:

"I have had, for the last seven years, much experience in the medical attendance upon persons who are total abstainers. During that period hundreds of that class of persons have been under my care. I find that, *as a class, they do not suffer from anything like the amount of sickness experienced by moderate drinkers;* that when they are sick, the sickness is much more amenable to treatment, and, necessarily, they are soon well again. Moreover, I am convinced that, in many cases, the patient's recovery was entirely owing to a life of previous abstinence from intoxicating beverages."

Further: "On comparing the results of sickness and death occurring in two large friendly societies under my care, one composed of total abstainers and the other of non-abstainers, I have arrived at the conclusion that the total abstainers have much better health, are liable to a much less amount of sickness, and have fewer deaths than the moderate drinkers. In the non-abstinent society, I find that the average amount of sickness experienced last year was eleven days twenty-one hours per member, and the number of deaths was about 1½ per cent. In the total abstinent society, the amount of sickness last year did not amount to more than one day and three-quarters per member, and the number of deaths was only two in five years, or less than ¼ per cent. per annum."

Notwithstanding, that in the ranks of what are called temperance men there are included many who have formerly been drunkards, a vast experience has shown that the total abstainers are not only as well able to perform their duties and enjoy the common pleasures of life, but their health, strength, and enjoyments are all improved; while the most painstaking English statistics do show that *the health of entire abstainers is one-half in advance of the health of moderate and free-drinkers combined, and their prospect of life is one-third better than that of moderate drinkers only.*

Several insurance companies of this country have made similar observations. The Northwestern Life Insurance Company of Milwaukee, having had thirty years experience, will not grant a policy to a lager beer brewer, to his clerk, to his bookkeeper, or to any employed in a lager beer brewery, because its directors have learned by sad experience that lager beer shortens and does not lengthen the lives of those who drink it.

If life insurance companies, ready to make a dollar whenever they can, have come to such conclusion after a thorough test, what must every sensible person conclude who has respect to his own health, or the length of his own years?

(2) *Climate and Alcohol.*—Liquors are direct and indirect cause of much sickness and fatality, in hot seasons and climates.

The more unhealthy any place is, the greater is the ratio of mischief by strong drink.

Dr. Daniell states: "It is a well-known fact that the notorious insalubrity of Africa has frequently served as a scapegoat on which the blame of those evil consequences (resulting from the reprehensible indulgence of dissipated courses) might be unre-

servedly thrown, without the risk of their being disputed."

"With us on the Congo," says Henry M. Stanley, "where men must work, and bodily movement is compulsory, the very atmosphere seems to be fatally hostile to the physique of men who pin their faith on whisky, gin, and brandy. They invariably succumb."

Concerning the Bight of Benin, Dr. Daniell says: "And yet, amid these regions so rife with disease and death, I have known Europeans reside for a number of years in the enjoyment of good health from the simple secret of moderately conforming to the habits of the natives as regards their diet, exercise, and attention to the due performance of the cutaneous functions."

Lieutenant-Colonel Sykes, after residing a long time in India, observes: "I ate moderately and drank little, and I have a strong conviction that much of European disease in India is traceable to over-stimulus, and that the mortality among European troops will not be lessened until the European soldier is improved in his habits; until he is made to understand that temperance is for the benefit of his body, libraries for his mind, exercise for his health, and savings banks for his purse. The climate is less to blame than individuals; for, in case foreigners find the people in a country healthy, they should, to a certain extent, conform to the habits of the natives to be healthy also."

During three years Mr. Gardiner was engaged in most active exertion in the malarious climate of Brazil, pushing his way farther than any other European scientist, and exposing himself to all conditions of weather. Through all, he rigidly adhered to the use of only water and tea.

When he first came to Brazil he was told that it would be necessary for him to mix wine or brandy in the water which he used. Of this, a very short experience convinced him there was a mistake, and that instead of such beverages being healthy, they were positively hurtful to persons exposed to the sun as he was. "Whoever," says he, "drinks stimulating liquors and travels day after day in the sun, will certainly suffer from headache; and in countries where miasmata prevail, he will be far more likely to be attacked by diseases which are there endemic."

In Tobago, the Europeans freely indulge, and their mortality is reported one out of three annually. Drinking goes hand in hand with great mortality in the West Indies; but here, as anywhere else, the degree in the use of alcoholics has more to do with the death rate than does the degree on the thermometer. Sir John Ross totally abstained. His first voyage was to Jamaica, where the captain and several of the crew died. Later, he went to Honduras, where all the common sailors died—twelve in number. "I was," said he, "the only person that went out in the ship, who came home alive; which I attribute entirely to my abstaining from spirituous liquors."

One wrote from the Isthmus in 1878: "Strong drink and the lustful excesses to which it leads should answer for three-fourths of the mortality which has given fame to Panama."

Dr. Phillip C. Williams, of Virginia, states what experience shows—that a strict observance of certain simple hygienic rules may greatly mitigate, if not entirely prevent, many of the diseases to which immigrants to hot climates are subject. Bearing in mind the strong predisposition to inflammatory diseases, the importance of avoiding everything that,

in the least, tends to aggravate the predisposition is obvious. It is important to restrain the activity of the digestive and respiratory functions. Hence, an early discipline of the digestive organs should be begun, even before leaving home, and the kind of diet and habits of life employed which are to be continued there. They should be cautious and temperate both in food and drink. The irritable condition of the digestive canal requires the exclusion of all stimulating food and condiments, a very cautious use of fruits, especially in the evening. "The drinks," says he, "should consist either of pure or slightly acidulated water, of water mixed with milk, or pure milk, when it agrees with the person using it. Buttermilk is preferred by some." Of stimulants, he says: "If such drinks be injurious when used in cold climates how much more so must they be when acting on a system already overstimulated by a hot climate? I am satisfied that many of the diseases formerly attending migration to hot climates can be traced to this unfortunate practice.

In his "Tropical Hygiene," Dr. Johnson observes: "The nearer we approach to a perfectly aqueous regimen in drink, during the first year at least, so much the better chance have we of avoiding sickness, and the more slowly and gradually we deviate from this afterwards, so much the more retentive will we be of that invaluable blessing—health."

The physician general to the British army, Dr. R. Jackson, writes: "I have wandered a good deal about the world, and never followed prescribed rules in anything; my health has been tried in all ways; and by the aid of temperance and hard work I have worn out two armies in two wars, and probably could wear out another before my period of old age arrives.

I eat no animal food, drink no wine, nor malt liquors, nor ardent spirits of any kind."

"I aver," says Dr. Mosely, on "Tropical Diseases," "from my own knowledge and custom, as well as from the custom and observation of others, that they who drink nothing but water, or make it their principal drink, are but little affected by the climate, and can undergo the greatest amount of fatigue without inconvenience." The hardy Arabs of the desert have no habitual drink but water.

(3) *Alcohol and the Soldiery.* — This same great truth appears in studying alcohol upon the soldiery. Wherever careful comparison has been made between those who use liquors and those who do not the same difference is seen. But few statements on this point, however, will be made since the ground has been fully covered by Drs. Carpenter, Forbes, and others.

Her Majesty's troops in India have been divided into three classes—the abstinent, the temperate, and the intemperate—and reports have been returned to England accordingly. For the first, the bill of mortality has been 11 in a 1000; for the second, 23 in a 1000, or something more than double; for the third class the mortality has fully quadrupled—*i. e*, been 44½ in a 1000. The proportion in which they were sick and in hospital for various diseases was, for abstainers, 130.8 per cent.; for temperate, 141.6.; for intemperate, 214.8 per cent., or nearly double that of the first, The great disparity in the above figures between those who were sick and those who died shows how much more fatal a sickness is likely to be in those who drink.

"In Kaffraria," Inspector-General Sir John Hall stated, "the troops were so placed that they had no means of obtaining liquor of any kind; and all attempts of the Winklers to infringe the police regula-

tions were so summarily and heavily punished by fines and expulsion that the illicit trade was effectually suppressed; and the consequence was, that drunkenness, disease, crime, and insubordination were unknown; and yet that army was frequently placed in the very position that the advocates for the issue of spirits would have said required a dram."

During the Kaffer War, in 1852, 200 men marched 1000 miles in 71 days, or at the rate of nearly 15 miles each day. They used water only. After the first day or two the men ceased to care about spirits, and performed this laborious march easily, and were brought back to camp in a more healthy condition than they had ever been in before. Not a man was sick through all this exposure; but, on their return, two of them got some liquor, and paid the penalty by an attack of dysentery.

In the Crimean War (1855–56), the Turkish troops, though otherwise under very bad hygiene, lost not more than 5 per cent. of their number, even at the times when the scurvy prevailed among them. On the other hand, the British, with their porter and spirit rations, never buried less than 10 per cent. Sir John Hall says: "Small as the amount of sickness and mortality was in the Crimea, they would have been reduced one-half, I am quite sure, could the rule that was observed in Kafferland have been enforced there." Dr. Lyons, reporting on this army, admits that the rations of porter were harmful, while the rum was simply deadly.

For more than twenty years rum rations were allowed to the soldiery in the Bengal Presidency, with a death-rate of 73 to a 1000. In the Bombay Presidency porter was partly substituted for the rum, reducing the death-rate to 50 in a 1000. In the Madras division scarcely any liquor besides porter was used,

and 38 in a 1000 died. Now, by subtracting 11 in a 1000, which is the usual death-rate of abstainers, from the above, we have 62, 37, and 27 to the 1000, as the sacrifice to this Moloch. In China, in Borneo, in Afghanistan, in the Ashanti War of 1874, like facts are shown. In short, all good writers on tropical climates speak the same. Upon this subject the greatest army surgeons, as Drs. Jackson and Martin, have spoken in no equivocal terms. All hunters and travellers in India give an experience of like kind.

Dr. Martin recommends warm tea as the best beverage. So Dr. Sir Alexander Armstrong, Medical Director of the British Navy, in a late expedition, expressly advised the regular use of tea and cocoa, and condemned the liquor rations. Dr. E. A. Parkes advocated the same, and declares that "the instances in which spirits are popularly supposed to be useful, are those in which hot water is taken with them, and the benefit is doubtless simply owing to the heat of the liquid." Thus, while Dr. Bowditch asserts that the pernicious action of alcohol is worse in the North than in the South, Dr. Parkes says: "The common notion that some form of alcoholic beverage is necessary in tropical climates, is, I firmly believe, a mischievous delusion; and teetotalers are more healthy and more vigorous than those who do not abstain."

Dr. Robert Jackson endured great hardship with exhausting labor in the West Indies without liquor, and was convinced that "the English soldier may be rendered capable of going through the severest military service; and that temperance will be one of the best means of enabling him to perform his duty with safety and effect." In the march of Sir James M'Gegor across the desert to Egypt, in 1804, no spirits were used, and the troops "were remarkably healthy."

In the autumn of 1846, the Tenth Corps of the Ger-

manic Confederation had 27,859 men under arms, 21,752 of whom received rations of spirits, and had 472 sick, or 2.17 per cent.; while 6107 received no spirits, and had but 79 sick, or 1.27 per cent.

In the Seventeenth Regiment, at Peshawur, India, and which consisted of 800 strong, there were 200 tee-totalers, only one of whom was invalided, while, to have kept pace with the proportionate sickness of the other 600 who used more or less liquor, there should have been 12 sick.

"My own opinion," says Sir John Hall, "is that neither spirit, wine, nor malt liquor is necessary for health. The healthiest army I ever served with had not a single drop of any of them. But immediately the men were again quartered in towns and fixed posts, where they had free access to spirits, numerous complaints made their appearance among them."

An instance or two from our own country must suffice.

Dr. Mann, who is among the few medical men to leave records of the Revolutionary contest, shows that at those periods when the army received no pay for their services, and so possessed not the means to procure spirits, it was healthy. "The Fourth Massachusetts Regiment, at that eventful period of which I was the surgeon, lost in three years by sickness not more than five or six men. It was at a time when the army was destitute of money. During the winter of 1779–80, there was only one occurrence of fever in the regiment, and that was pneumonia of a mild form."

In the winter 1814–15, the soldiers at Plattsburgh were not attacked with fevers as they had been the preceding winters. The troops, during this period, were not paid—a fortunate circumstance to the army—arising from the want of funds. This embarrassment,

which was considered a national calamity, proved a blessing to the soldier. When he is poor in money, it is always the case that he abounds in health—a fact worth recording.

Experience in our late war abounds in like facts. In 1862, a writer on the Army of the Potomac, consisting of 250,000 men, speaks as follows: "I had occasion to observe a remarkable difference in the appearance of the different regiments. In some cases I have found their men dirty, their camp disorderly, and their whole appearance shabby; in others, everything neat and tidy, orderly, and well-disposed. On inquiry, I have found that the difference was owing, in great degree, to the course the commanding officers have pursued in relation to the use of intoxicating drinks. Where, as in a great many instances, the colonel has enacted a 'prohibitory law,' and forbidden the admission of liquor into the camp, I find everything in the best condition, the best health, the best order. I was much gratified to find that a great many officers and soldiers abstained entirely—not because they were compelled, but because they chose to do so. No small number of officers in high command are teetotalers. The result of my observations in regard to temperance in this great army at Washington is, that *the common-sense of both officers and men is strongly in favor of prohibition;* and, wherever it has been enforced with fidelity and vigilance, it has been in the highest degree beneficial."

That strong drink is prejudicial to good order and contentment, it wanted not our late war to determine. More than eighteen centuries ago Emperor Domitian forbade the cultivation of the vine in Ionia, because, as he saw, the use of wine tended to turbulence and sedition. From the same reason, rather than any real religious motive, Mohammed was led,

at the early part of the seventh century, to prohibit the use of intoxicating drinks among his followers—an act which has mainly saved the lands of the Moslems from the curse of drunkenness. But, ignoring this practical truth, some scientists talk of "thermal lines" as governing in the spread of intemperance. How foolish![1]

(4) *Other Showings.*—When Dr. Dickinson made the analysis of the 149 drinkers who died in St. George's hospital in comparison with the same number of persons who did not drink, he found that the ages of the users of liquor were, on an average, three and one-half years less than the ages of the temperate men—the former dying at 36.8, and the latter at 40.6; the shortness of life in both classes being partly due to the fact that the calculations were made on hospital patients only.

While Dr. Parkes would find his strongest argument for total abstinence in the moral influence of

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[1] Dr. H. I. Bowditch, whose unfortunate notions have afforded so much "food and comfort for the enemy," forgets the influence of certain religious systems of the South, particularly Mohammedism, in restraining the spread of drunkenness; it being forbidden by the Koran. To be sure, the Bible forbids intemperance, but its precepts are enforced upon those who profess religion and voluntarily enter the Christian church, and not necessarily upon nominal Christians; while Mohammedism, as a politico-religious system, embraces and is enforced upon all who are born under it. But, on the authority of Consul Sela Merrill, there is much drinking even in Palestine, not openly, as among most people, but secretly, they taking the liquor home and drinking it there. A banker of life-long residence in Jerusalem states that two-thirds of the people of that city go to bed under the influence of drink. The Turkish officers of the garrison, even though Moslems, as a rule, use strong drink freely; which practice is rapidly spreading among the Mohammedan people at large.

intemperance, he says: "Nor does any one entertain a moment's doubt that the effect of intemperance in any alcoholic beverage is to cause premature old age, to produce or predispose to numerous diseases, and to lessen the chance of living very greatly."

Of the 178 cases of death coming under the notice of Medical Examiner Dr. F. A. Harris, of Boston, 40 were due directly to alcohol.

J. W. Turner, of the Royal College of Surgeons, confirming the statement of Dr. Beale that people would live longer if they drank less alcohol, says: "From my own experience, after thirty years' practice, I positively declare my opinion that half the untimely male deaths (innate phthisis excluded) are owing to the abuse of alcohol; and I *judge it incumbent on the medical profession, as guardians of the public health and well-wishers of their fellow mortals, to make this evil of alcohol drinking better known.*"

"Let me ask my professional brethren," says he, "the cause of a vast amount of kidney and liver diseases, diseases of the brain and nervous system, insanity, paralysis, and idiocy? From what cause more than one-half the accidents which fill our hospitals? What number of suicides occur in the depressing stage following over-excitement of alcohol? How many murders in the non-natural state produced by it—not to mention the many cases of assault which appear before our police courts and crowd our prisons? How many miserable, alcoholic dyspeptics apply daily to the profession for aid, and too often confirm their ill-health by persisting in the use of stimulants that have brought them to their wretched condition? Can we imagine that the public is fully aware of these facts? and that from *alcohol or spirits of wine in small doses a person is quickly placed in such a non-natural condition as will excite*

him or her to commit such acts as in their normal state they would shudder to think of? and that such excitants are permitted to be vended at every corner to any empty-stomached or empty-headed customer with a few pence about him? and that the habit of drinking grows like a dire disease upon the drinker? So great a craving and horrid depression possesses him that he almost always resorts to the enemy for relief to his symptoms. Then begins the indigestion of spirit-drinkers and the varying conditions of the animal spirits called 'ups and downs'—all the false excitement of the 'ups' and all the morose ill-temper and brutality of the 'downs.' A short course of this kind brings the nervous tremors and that incapacity for sustained mental or bodily exertion without the prop. . . . Not a day passes without such sad evidence of the dire evils of spirit-drinking being brought to the direct knowledge of medical men, *and they, of all classes, I think, should give utterance to their opinions on this subject.*"

That all sorts of liquors tend to the destruction of both health and life—some more than others—there can be no question. The very carefully-prepared tables of "Vital Statistics" of Mr. Neison bring this into full relief. He shows that from twenty to thirty years of age the mortality among intemperate persons is five times as great as it is among the temperate; and from thirty to forty it is four times as great. Those who are intemperate on spirit die sooner than those who are intemperate on beer. But this is not so much to the credit of the alcohol in the beer over the spirits as to the fact of its greater dilution—old drinkers usually taking their spirits with little or no water.

4. *Alcohol and Offspring.*

This is the last count to be made. In order for clear ideas, I turn the subject into three views:

1. *Alcohol and the Formative Material—Protoplasm, Bioplasm.*—The proverb, *ex nihilo nihil fit*—nothing comes from nothing—is fully applicable to organic life. It is a truth of science that "all living structures spring from preëxisting living structures." These structures undergo perpetual change—they grow, are nourished, exist for a time, die and are removed; they have the power of assimilating to themselves lifeless matter, and communicating to it their own living properties; they have the power also of multiplying, under certain conditions, to originate other organisms like their own progenitors.

The *primary germinal matter*, or *protoplasm*, exists in minute particles. It is a *soft, albuminous substance*, and possesses the peculiar power of *spontaneous motion*. In the midst of this delicate substance are nuclei, or vesicles, which are the germinal points. They divide and subdivide, causing division of the protoplasmic mass with them, thus forming new cells and building up the organism in whatever direction that may be. The *white blood*-cells—previously noted—are bodies of this nature, seen rolling along in contact with the vessel-walls in which they circulate.

Now, of all the agents known, nothing acts so rapidly and so efficiently upon these sensitive substances as alcohol, causiug arrest of the spontaneous motion, and the evolution and development of the embryonic cells—a statement in accordance with the teachings of Dr. L. S. Beale, of London, a great microscopist and authority here.

The well-known property of alcohol to coagulate

albuminous fluid, and to shrink and condense solid tissues outside the body, has its fullest application to the albuminous juices and delicate tissues predominant in early life. But, to dispel all mystery on this point, let us look at a matter of common observation, using the cultivated eyes of Dr. Beale:

"If there be a little abrasion of the cuticle, around which the skin looks red and angry, the neighboring tissue being hot, swollen, and painful, the capillaries distended so as to produce a bright redness, it will be found that the occasional application of a drop of alcohol to the affected part will, in the course of a single hour, produce great changes. Numerous small particles of living bioplasm are receiving an unusual quantity of soluble nutrient substances, and are consequently multiplying rapidly in the deep layers of the cuticle. . . . . Now, what happens when a drop of alcohol is applied? Momentary pain, followed in a few minutes by relief, or complete cessation of pain, and diminished vascularity. But how does alcohol bring about these striking changes? If alcohol be added to any serous fluid, as is well known, the albumen is precipitated. If delicate masses of bioplasm are placed in alcohol, and afterwards examined under the microscope, they will appear very granular, and will have become shrunken and altered in form; they will resist disintegration by pressure to a greater extent than in their natural state. By the action of alcohol the surface of a wound is much altered, and it soon becomes covered with a dry crust. This results from the hardening effects of the alcohol. Some of the rapidly-growing particles of bioplasm are quite destroyed, while others become surrounded with an envelope of hardened matter, which prevents the possibility of their absorbing nutriment and giving rise to new particles,

and growing and multiplying as rapidly as before. Not only so, but the permeating power of the nutrient fluid itself is reduced by the tendency of the alcohol to coagulate it."

We can tell at once by the character of the formative cells whether they grow as they ought to grow, or too slow or too fast. "Whenever," says Dr. Beale, "the outer part of the cell (formed material) is firm and hard, and not very permeable to nutrient matter, the growth must have been slow. On the other hand, when the envelope is very thin, or where there is no envelope or cell-wall at all, the greatest facilities for rapid growth exist. Everything which tends to coagulate or harden *bioplasm* (cell-substance) on its surface will have the effect of retarding its growth."

The bodily growth of animals is often stunted in this way. Says Dr. James Ross: "When dog fanciers wish to produce a small pet dog, the animal is given a certain amount of gin daily from birth till the period of growth is past; and this proceeding is effectual in producing a dog much smaller than the parents, or the other dogs of the same litter."

Recent experiments by MM. Mariet and Combemale on dogs confirms the worst said concerning tissual changes. They show that *still-births, early deaths, tissual and intellectual perversions of pups are rife when mother dogs are fed with liquor.*

2. *Effects of Alcohol on Children After Birth.*—I have already mentioned this subject in illustrating the effects of alcohol on the blood globules, and so have but little to say here. There are two particular sources of danger to be guarded against—the introduction of the alcohol through breast milk, and in the form of *cordials.*

Not only is the spirit filtered through the breast of drinking women, but analysis of the milk shows that

it is itself altered in constitution; that its most essential elements are diminished, so that *the breast gland, in common with every other secretory organ*, is crippled in its function by the presence of alcohol. Hence, they who supply breast food make a serious mistake when they attempt to supplement their own physical efforts by the false support of alcoholic liquids. They render the milk doubly dangerous, so that it is no wonder that such children are weak and sickly, emaciated, and subject to fits and all the array of bowel troubles. Such a course, therefore, should not be tolerated for a moment.

Richard Grant White was struck with horror at the besotted condition of many of the English women he saw in his travels—women bearing children every year, and suckling them. They seemed to him "little better than foul human stills through which the accursed liquor with which they were soaked, filtered drop by drop into the little drunkards at their breasts. To these children drunkenness comes unconsciously like their mother tongue. They cannot remember a time when it was new to them. They come out of the cloud-land of infancy with the impression that drunkenness is one of the normal conditions of man, like hunger or like sleep."

The danger from administering *liquorous cordials* and *stimulants is very great;* and some of my sharpest battles have been fought right here in defence of the little ones. Just while writing this I have had a hard struggle to save a little girl carried down to death's door by such unwise administration.

Children worry from unfit clothing, improper feeding, or other causes which a little intelligent searching would discover were it made; then the *panacea*—the evidence of stupidity—is resorted to, and the little sufferer, narcotized and possibly made quiet for the

time, is made worse on the whole, if not positively jeopardized. It is made feverish, its appetite is destroyed, and weakness, thinness, and softness of flesh come on. A while since, a woman told me that she thought brandy was good, and that she gave it to her children instead of sending for the physician. Of eight children, I found she has one alive, and yet she had the hardihood to advise me to give it to my patients. Surely such results cannot be a commendation for my use.

Dr. H. I. Bowditch speaks very mildly when he says: "An undue and intoxicating indulgence in the use of liquor in this early period is more liable to sap the sources of health than it may be beyond the period of adult life. At the former period it tends, I have thought, to develop phthisis, by its general deterioration of the system. I should never advise the *general use* of any liquor at an early period. Nor do I think any parent or physician justified in so doing."

Dr. James Ross was told by a medical man that he had kept a prematurely born child alive for the first three weeks by feeding it with whisky toddy. Seven years later the child was a puny little idiot.

Dr. Ross has seen instances of dwarfing which he believed due to the use of alcoholics when they were young. Doubtless we have all seen such cases, for they are all about us, only we do not recognize the cause.

The facts collected by the Hon. John Jay, United States Minister to Austria ("Report of the Massachusetts Board of Health for 1872"), make a strong showing. He has, however, compared the effects of one liquor with another and not with total abstinence, which is the proper standard.

"The different provinces of the country show the

different effects of the ale, wine, and ardent spirits. Three groups of provinces can be named as varying most. They can be classified according to the liquor most generally used. It is found that the Western Provinces, where beer is most used, stand highest; the wine-consuming Hungarians are much below them; while the Galician peasant, who ruinously exchanges for brandy his corn before it is ripe, is lowest in the scale of industrial development. Indeed, the degeneracy of the race in Galicia, is to be sought mainly in the excessive use of corn-brandy, and thence it comes to pass that out of the men called to military duty in Galicia, 37.9 per cent. are rejected as unserviceable on account of physical disability and infirmity, and 18 per cent. on account of *under-stature*. Accordingly, in all, 55.9 per cent. (more than one-half) of those called are unserviceable in the army, while in the entire monarchy 33.5 per cent. are rejected on account of physical disability and infirmity, and only 9.2 for under-stature."

A man of Lucerne, and member of the Cantonial Legislature, confirms the same. He says: "Some time ago I had the charge of enrolling the citizens of that Canton subject to military service, and was struck with the difference between the people where wine is produced, and has always been a common beverage, and those of other districts where wine is not used, and schnapps is the common drink. The physical superiority of the former class was very striking, and the percentage of able-bodied men in the wine-producing districts very much greater."

Even on this wine basis, with all its evils, Dr. Bowditch says: "Thus we get from our correspondent a most shocking array of evidence proving that the free and intemperate use of ardent spirits not only crushes out manliness but actually dwarfs the off-

spring. The sin of the intemperate use of ardent spirits is visited not only upon the third and fourth generations, but must act in all time unless *radical reform be instituted.* Even if a reform be begun, several generations will be needed to redeem the progeny of such a degenerate race. What a warning this to our country in regard to the use and abuse of ardent spirits!" "A man," he says, "who, knowing this, voluntarily exposes his mind and body to the influence of these ardent spirits, commits an act which, *a priori*, one would deem impossible for any reasonable man voluntarily to perform, any more than he would consent to have himself changed into a chattering fool or a savage brute."

Dr. Sieveking, speaking of the foundations of good health and long life, says: "During the latter period of childhood, the employment of artificial stimuli of all kinds—physical, emotional, and intellectual—largely impairs brain-growth, either by a development of one part of the organism at the expense of another, or by directly stunting the entire process of nutrition."

Reflecting on the foregoing, we see the illusiveness of what is popularly known as *stimulants*, and are convinced of the truth of Dr. Ross' conclusion that the "effect of alcohol upon the higher organisms is to check growth and to consolidate structure; and that a result of its habitual use is to produce to a greater or less degree a decay of all the powers of life."

Said Dr. Nathan Allen, in his address before the Massachusetts Medical Society, in 1874: "That alcohol is one of the most powerful causes of physical degeneracy now in operation, no one will probably question. If to alcohol we add tobacco, opium, and other stimulants and narcotics, no pen can describe the terrible injuries which they inflict upon the human race."

3. *Effects of Alcohol on Unborn Infancy.—Heredity.*—A volume would not do justice to this subject. Dr. Allen asks: "From a hygienic view, of what avail are the benefits of good air, pure water, wholesome food, healthy occupations and dwellings, when the laws of the physical system are being constantly violated by the poisons of alcohol and tobacco? It is not alone the present or temporary effects of these agents, but the *permanent, such as are incorporated into the organization itself and become a part and parcel of it—these are the seeds of evil tendencies and diseases, which are transmitted to successive generations. It is only when we take into account the power and extent of hereditary influences that we can fully appreciate the importance, the magnitude, and the grandeur of the temperance reform.*"

The *child before birth* is more intimately connected with its mother than afterwards, since it gets air, so to speak, as well as its food directly from her. After birth it gets oxygen from the atmosphere, and its food from her milk, which is a second remove from her blood. Yet, even now, if she uses liquor, her milk is impregnated with the alcohol and her child damaged. But before birth, her blood comes in contact with that of the child, so that its tissues are as easily saturated with alcohol as her own, while it cannot as well throw off the alcohol as if it could only breathe. It is only after a prolonged intoxication the child can get relief. It is, therefore, much less harmful to feed the tenderest infant with spirits than that a woman in the family way should take liquors into her body, and so intoxicate her unborn child.

But another fact, not generally known, makes against indulgence in alcoholic liquors at this period which is this:

The blood of the placenta goes to the heart of the fœtus as arterial blood. It is there divided, the

larger portion going to the brain and upper half of the child's body. Returning to the heart as venous blood, a portion of it passes in and mixes with the remaining portion which came from the placenta. This mixed blood goes to the lower half of the fœtal body, which is nourished just as reptiles or cold-blooded animals are nourished. This circumstance explains how the upper half of the fœtus advances in development over that of the hips and lower limbs. Were it not so, the child would need to be born weeks before it is, and the powers essential to its life after birth would be far behind what they now are. This fact also shows how the brain and other most important organs must receive the alcohol of its foolish mother point blanc, from which the lower extremities in part escape. How seriously, then, are the best parts of unborn infancy exposed to the ravages of alcohol when that alcohol is taken into the stomach of its unthinking mother! Indeed, who has not observed the idiotic and stupid appearance of the children born of women who stupified themselves with beer when in the family way?

This peculiarly intimate relation between the child and its parent explains how it can but be true that the mother's influence over unborn infancy is greater than the father's. How fortunate, then, that drunkenness does not prevail among women as among men! Esquirol frankly taught that the mother had superior influence. So did Baillarzer and Dagonet. Gintrac not only advocated it, but taught that "the children of female drunkards, if they escape the morbid influences which compromise their existence in the womb or at birth, are often idiots, imbeciles, insane, or epileptic." There is no possible doubt that drinking at this time is a frightful cause of death, to say nothing of the injury done by the frequent resort to

the gin bottle when pregnancy is suspected. Dr. W. H. McDaniel instances a case of the death of a child at full term from a heavy drunk on the part of its mother; and Dr. Figg instances one where the child never stirred again after its mother drank.

Studying the *incipient germinal matter, or protoplasm of the being to be*, there can be no more difficulty in regarding it as being invaded and modified in function by alcohol than in regarding the same thing of the protoplasm of the different tissues and organs of the growing child. We know the subtle character of the agent to penetrate and permeate every part, especially those that are tender and moist. It is with alcohol in the body as it is with worms on our plants—the more tender and juicy the parts the more readily are they sought and destroyed.

The protoplasm and the cells—the first beginning of bioplastic organization from it—may be modified in either or in both parents, so that when the cells of the two are brought in contact in fecundation the incipient being may be stamped with the vitiated condition of its parents from the outset of its existence—a fact which is abundantly supported by considerations which physicians well understand.

Whatever thereafter may be the influence of the mother over the product of conception till it becomes an independent being, it is certain that the father's physical influence must stop with conception. Up to this point, however, his influence must be as great as hers. And it is truly amazing that so much of the physical and mental characteristics of either parent should, in so slight a way, be conferred upon their offspring. But this is the fact. And not only the features, but various forms of constitutional disorders and taints thus express themselves. And not infrequently the taint which may fail to appear in the

children may spring forth with all its force in the children of the second generation, and so on in alternate generations by the law of *atavism*, as it is called; or the tendency, which may lie dormant in the immediate descendants, may break out in some collateral branch of the family line. "A person, therefore," says Dr. Aitken, "cannot be considered free from the inheritance of constitutional maladies simply because his parents may not have suffered from any of them; and now it is admitted that, under at least *three generations the iuvestigation of hereditary tendency is uncertain.*" Hence, as Dr. Allen observes: "To effect any great improvement in this direction would require a favorable operation of the laws of inheritance through several generations."

The poison of the "*social disease*," so called, strikes its roots to the very bottom of the constitution, and is truly frightful in its transmisible tendency. A lad of twelve years of age was presented to the late Prof. S. D. Gross, of Philadelphia, for trouble in his head, horribly fetid breath, loss of the bones of the nose, and a *peculiar* but well-known ulceration. The boy had been fairly well, though not very strong, till within a few years, when this disorder showed itself. "Have you been well yourself," said the Professor to the father. "Were you never troubled with any *sore mouth*, *any eruptions*, or *ulcers* of *any kind before this child was born?*" The father owned that he had had *one little sore six years before his marriage*, *but got all over it*; and such a blessing as the father got! "Gentlemen," said the Professor, turning to his audience, with a pathos which made our blood run cold, "this is the most terrible disease beneath the sun."

When the influences of these corrupt and corrupting tendencies are considered from the standpoint of a practising physician there can be little wonder now-

adays at the general unwillingness among women to become mothers, especially in our crowded settlements, lest the sins of the parents find them out, and they be doomed to nurture the degenerate branch of a degenerate vine; for the transgressions of progenitors are burnt by heredity into the physical, mental, and moral constitution of their offspring for generations to follow. A friend of mine, an old schoolmaster, relates that he once had a boy in his school who had all the appearance of one drunk. The origin of this apearance was easily traced to the fact that his father and grandfather were both drunkards, so that the lad *iuherited the very staggers* of his drunken progenitors. I personally know a man whom I supposed to be in the last stage of chronic alcoholism, so truly does his appearance correspond with the symptoms of that broken state. But the man and his friends declare he never drank. His parents indulged, and he is a remarkable instance of the transmission of the tremors, staggers, stutters, and other symptoms of it. Voisin found twelve out of ninety-five epileptics to have had ancestors drunken during the honeymoon. Marcet mentions a drunken father who boasted of sixteen children. Of these, five were dead, and all the rest epileptics.

Says Dr. Tarquet: "The children of drunkards are not all of necessity idiots, lunatics, or epileptics, but there are few that present nothing abnormal; and in those of seeming freedom the germ may be late in developing itself." Fusch refers to three sons of a drinking father, two of whom early followed his example, and the other fell into the habit all of a sudden at the age of thirty.

The Chaplain of Clerkenwell Prison reported a grandmother, mother, daughter (the latter with a babe at her breast), all in different cells at the same

time, and all for drunkenness. What will the baby do?

But alcoholic heredity carries with it more than the mere taking to the cup; it leads to suicide and to every namable crime.

Nowlin, of this State, was a drunkard, a dipsomaniac, and is dead. His second son, aged seventeen, expiated on the gallows a horrid murder, while two younger sons have received sentence.

Dufray mentions four brothers, sons of inebriety, all of whom took their own lives. The following shocking facts are by Tarquet:

The head of the family was a drunkard and a debauchee. His wife, though remarkably sober herself, was the daughter of a drunkard, and had two brothers, both drunkards. These parents brought five children into the world, three sons and two daughters. The oldest boy was like his father, and had three dissolute children. The second boy has been twice sent to the asylum for mania and homicidal impulses. The third was a debauchee, and died of consumption, of which there was none in the family, at the age of twenty-one. The oldest girl married, and is the mother of a licentious, drunken thief. The second girl, though married, has lost all moral sense and decency, and is leading a most irregular life.

The hundreds of irregulars developing in the "Juke family," of New York, is notorious of what inheritance does in this direction. Like reasoning from bad premises, however correct the logic may be, the conclusion is wrong.

"We venture the assertion," says Dr. Allen, "that all permanent improvement or progress in the civilization of any people or nation is more dependent on these laws than upon any other agency whatever. If one-fourth the attention or one tithe of the expense

was given to the improvement of the human race in this direction, that is now expended on that of domestic animals, it would result in the most surprising changes."

In this light it may be safely assumed, that habitual drunkards, either husband or wife; that persons previously given to protracted inebriety, but now reformed; and that persons now under the influence of liquor, though usually temperate, should not produce children. And, indeed, fortunately for the world, the power to do so is often aborted. Nevertheless, it is an observed fact that the families of drunkards frequently are more numerous than the families of the "higher circles." But this is no credit to alcohol only so far as it necessitates poverty with its attendant toils and simple living—circumstances infinitely more favorable to conception, especially among women, than a life of luxury and ease.

There are *two important facts* concerned in this *initial physiology* of children: First, it is essential that there be a due or *normal amount of nerve power* as the vital moving force, on the part of the parents. This we have elsewhere shown is greatly depreciated by indulgence in strong drink. Second, there is required a proper or *normal condition of the blood* as the natural and necessary basis of supplies to support this force. And we have also seen how crippling is alcohol upon the blood globules, the active elements of the blood. With alcohol in the body, the nerves weakened, and the blood perverted, the only wonder is that any offspring should be produced who are not runts or imbeciles. That it is not so, is not in favor of alcohol.

Dr. Heywood Smith, in an article in the *Medical Press* for 1884, goes over the whole ground of the use of alcohol by *parturient women*—the conceptive phase,

the gestative, the parturient, the puerperal, and the nutritive phase—and concludes in these words: "I trust that I have in this short paper proved that the administration of alcohol to parturient women is an unmitigated evil; that in every stage through which she passes it is fraught with the gravest results, both near and remote; and that he does best, who steadfastly, himself conscientiously convinced of the importance of the subject, sets his face to warn women from the pitfall, at the brink of which they may be standing, and to point their minds to a higher channel for satisfaction, and their bodies to a purer beverage."

Not only is infancy damaged directly through the alcoholized blood of its parent, but the *mental condition* of unmarried motherhood which prevails in all beer-lands cannot fail to have pernicious effects.

Throughout Germany illegitimacy predominates as in no other country of Europe. In Austria, where the greatest amount of beer is consumed, illegitimacy is the worst. Thus, in Prague, according to Legoyt, illegitimacy is 50.5 per cent., in Vienna, 50.9; in Styria, Corinthia, and Olmutz it reaches the enormous proportion of 64.6 to 70.2 per cent. of the births. Where *both parents indulge the effects on their children is simply appalling*.

Dr. Charles A. Story, of Chicago, mentions a family of seven children, one of whom, though twenty years old, is a fool, and goes about the streets astride a stick "playing horse." Says the Doctor: "Both parents were beastly drunk at the time of conception. They quit drinking; and the other six children inherited about average intellect." He speaks of another family where "the first child has average common-sense; the second is very much demented; and the third is a slobbering, drooling fool." This is

explained thus: "After marriage, the parents began drinking, and in six years had become perfect sots."

In a certain town, where the writer became personally acquainted with nearly every family, there were more adult idiots than he had ever seen. He was brought up where there was little drinking and no real drunkenness and a real fool was a rare sight. But in the town referred to, the early settlers for a time were given to drunkenness to a remarkable degree. And where the drunkenness was the worst, and especially where both parents were addicted to the cup at the time they were bearing their families, there he had learned to look for the "tell-tales," and there, too often, was found the bloated "squab" or the disgusting "what-is-it." One man and wife of more than ordinary parentage and education "opened shop" and fell themselves into the use of "the ardent" from the outset of their married life, so that she was often brought in from the gutter near the house while in the family way, and withal she soothed her pains with a free use of morphine. It would have been well for the world if the law of precaution with them had failed just here. But it did not, and they had a large family which illustrated many shades of "human weakness." We may safely say that the common measure of humanity—the rule of common-sense—would have been too long for any of them; and the pinched head and stunted form varied up and down about as the parents let up or continued their wretched practice. For the credit of humanity, however, a widespread reaction took place, and sobriety became the standing order of the day among the people, and the reign of idiocy quite passed away.

Dr. Albert Day, of the Washingtonian Home, of Boston, and Dr. H. R. Storrer, a classmate of the writer, both agree in saying that "epilepsy, idiocy,

and insanity, whether noticed at birth or whether developed later in life, with or without any exciting cause, are among the direful effects so often seen by medical men in the persons of the children of those who are addicted to the habit of intoxication.

"It is not," say they, "merely the man or woman inflamed by alcohol—at or near the time of sexual intercourse—that implants the fatal disease in the child at the very moment of conception; not this and these only; but they are equally guilty, perhaps more so, who—with their blood diseased from long saturation with this poison, their nervous system shattered, and the very foundations of their being tainted—proceed deliberately to engender offspring."

"It is not," Dr. Allen writes, "the mere physical properties of the body alone that are transmitted, but the dispositions, the propensities, the mental capacity, the moral sentiments, etc." In this light "the laws of inheritance assume an importance, a magnitude that can scarcely be overestimated."

Continues this learned physician: "The increasing use of alcohol in its various forms, and of tobacco, among young men, must have a most pernicious influence upon physical organization. But it is in the accumulated, the intensified effect produced by the law of inheritance, that the most striking and destructive results are witnessed. Could the evils of alcohol, tobacco, and opium, as transmitted by hereditary influences, be fully realized, what more powerful motives could be presented for a reform in their use or for their absolute prohibition? . . . No true physiologist, who understands the terrible effects of these poisons on the system, and their transmission to the second, third, and fourth generations, can look on such a state of things without apprehending the most serious results."

Demeaux maintained that intoxication of parents at the time of conception is the chief cause of nervous affections among the newborn. The great Plato, more than a score of centuries ago, understood this law and forbade the use of wine by the newly married.

Dr. Leeds well says: "Alcohol perverts the brain of the unborn child; it strikes a blow at reason and virtue in the very womb; and in its higher use it is the teeming fount of the sad idiocy which disgraces and depresses our boasted civilization."

In a "Report upon Idiocy," Dr. Howe, of Massachusetts, a few years ago, set forth the fact, from the most careful study, that of three hundred idiots, whose parentage was known, one hundred and forty-five, or nearly one-half, had inebriate parents. And in one family, where both parents were drunken, seven fools graced the family board.

Thousands of instances attest the fact that reformation from drinking has resulted in an improvement in the children afterwards born, over those coming into existence while their parents were addicted to the cup.

United States Commissioner of Education, General John Eaton, gives 80 per cent. of the crime of this country to intemperance, and 95 per cent. of the depraved youth as the children of drunken and depraved householders.

M. Lunier, of France, estimates at 50 per cent., at least in the great cities, the idiots and imbeciles whose parents were drunkards. Children born of parents when drunk, or who were constitutionally drunkards, according to this great authority, are weak in some way in the majority of instances.

In the year 1825, the restriction on the production of ardent spirits, which had existed many years in

Norway, was removed and "in a very few years the number of the insane was twice as great as before in proportion to the whole population, while the number of idiotic children born had increased in a still greater ratio."

Dr. A. N. Daugherty, of New Jersey, records his deliberate judgment when he says: "There are, unhappily, many, very many, persons born with a proclivity, a natural aptitude to indulge in intoxicating liquors, which only needs favoring circumstances to be developed into fatal activity. Their parents have transmitted to them this among other constitutional tendencies. As scrofula, as pulmonary consumption, as gout, as insanity, comes by inheritance, so does this."

The *periodic form of intemperance*, or dipsomania, by the best authorities, as Dr. Carpenter and Dr. Hutchinson, is often transmitted. Say they: "It is frequently hereditary, being derived from a parent predisposed to insanity, or addicted to intemperance." Drs. Willard Parker, of New York, and B. W. Richardson, of London, speak in the same way. Said the latter ("Diseases of Modern Life"): "The mischief inflicted by it on man, through his own act, cannot fail to be transmitted to those who descend from him, while the propensity to its use descends also, making the evil interest compound in its totality."

But this law of heredity is no strange thing. Plutarch taught that "one drunkard begets another;" Aristotle, that "drunken women bring forth children like unto themselves;" and a Greater than they said: "*The fathers have eaten sour grapes and the children's teeth are set on edge.*"

Bad as is the effect of liquor upon the bodies and minds of those who drink it, *it is far worse on the*

children who spring from them. This truth is corroborated by Dr. T. W. Fisher, of the Insane Hospital in this city, and by other observing men.

"I suspect," said the late Dr. G. M. Beard, of New York, that the worst effects of intemperance in the use of alcoholic liquors are least known and least noticed. It is the silent destruction of the nervous system; the slow poisoning of the great centres of thought; it is the transmission, by inheritance, of the evil from parent to child, from generation to generation, even more, perhaps, than the groans of the widow, the cry of the murdered man, or the tears of the orphan, that has made the temperance reform a necessity."

Not to himself alone, then, dose a man betake himself to the intoxicating cup; generations of the unborn are hanging on his heels. In the words of Dr. Crichton Browne, "his daughters are nervous and hysterical; his sons are weak, wayward, eccentric, and sink insane under the pressure of excitement of some unforeseen exigency, or of the ordinary calls of duty."

What a frightful train does the drunken man draw after him—mental, moral, physical wrecks of every shape and kind! as if a demon from the pit had come upon the earth to show how greatly he could contrast his work with the works of God.

Hard, indeed, is the lot the drinking man has chosen; for repent and reform as he will, he cannot regain the physical loss he has sustained by the cup. Like is he to what the Africans say of a man bitten by the lion—he never fully recovers, but ever and anon, to the day of his death, feels the horrid pain, as if the beast were still tearing his flesh. But sadder still is the thought that his children, who have never tasted of the poisonous cup themselves,

have tasted it in him, and they too must feel the teeth of the same savage devourer. Ushered into the world with innate proclivities to drink, weakened in their mental and moral powers, ofttimes fed with the "sugar of the cup," and reared under the cloud of a dark example, who wonders that drunkards' children do as their fathers have done, and lie down in early and dishonored graves? To my latest day I cannot forget the show of heroism of a friend of mine, whose ancestry had all gone the wrong way, when he resolved "*there shall be one man by my name who does not drink*," and cast the cup aside.

But, as if to disrupt a chain of sequences which moral force cannot do, nature ofttimes takes the work into its own hands and introduces a fortunate circumstance just here: the third or fourth generation of topers can do no more; they have played out. Physical forbearance has ceased to be a virtue, and barren love longs in vain for children to cheer their days and smooth their rapid pathway to the grave.

An agent of such power—that perverts the action of the blood and nerves; that produces the state of chronic alcoholism with its swarm of disorders; that breeds insanity; that severs the thread of life ere it is spun; that begets idiocy, mental, moral, physical infirmity—is it not a POISON?

THOUGHTS TO THINK ABOUT:

DR. B. W. RICHARDSON, of London: "The mass of the blood is water, the mass of the nervous system is water, the mass of the active vital organs is of the same fluid; the secretions are watery fluids, and if in any of these parts any other agent than water should replace it, the result is an instant disturbance of functions that is injurious in proportion to the displacement."

DR. JOHN P. ASHCOM, of Renovo, Pa.: "Alcohol will not assimilate with the secretions of the stomach any more than

a streak of lightning will. The depression following its use counteracts all the possible benefits supposed to be derived from it in stimulating quantities."

PROF. CHARLES A. CAMERON, Royal College of Surgeons, Ireland: "That alcohol is incapable of forming any part of the body is admitted by all physiologists. It cannot be converted into brain, nerve, muscle, or blood."

PROF. E. A. PARKES, Netley, Eng.: "Experience decidedly shows that the highest health, the greatest vigor, and long life are quite compatible with entire abstinence from these liquids."

DR. T. LAUDER BRUNTON, London: "The vital processes are much more readily arrested on account of waste products within the body than by any want of nutriment of the organs themselves."

SECTION II.—IS ALCOHOL A FOOD?

Food is something capable of being converted into the substance of tissue, or of evolving some form of force within the body. A stone is not food. Science and experience declare against it. Like a house, the body is material, and must be built of and sustained by material.

I. THE CHEMISTRY OF THE BODY IN RELATION TO FOOD.

Animal or physiological chemistry does not deal directly with simple chemical elements, but with these more or less compounded into substances termed *proximate principles*. The primary business of the vegetable world is to combine the simple elements existing in the earth and atmosphere into complex or organic substances. These constitute the food of animals, and were it not so, there could be no animals. Hence, in the order of nature, the highest efforts of the plant world in the production of fruits, grains, sugary and starchy roots, and succulent fibre, is the lowest point at which the animal world can

begin its subsistence; and even if one animal eats another, his tissues were primarily derived from vegetables. And whatever inorganic elements get into the blood, they traverse it and leave it in their natural state, as salt and water do. They cannot be created by it.

We have considered the elements which enter into alcohol, and the manner of their composition and decomposition. We now meet the question: Can alcohol or any part of it be incorporated into the animal body? This leads us to inquire: *What are the proximate principles of the body?*

I have constructed the following from Dr. Dalton's "Physiology," which contains all of them that can interest us here; comprehending the three classes, and indicating where each substance is found, except those of the second class, which are the general supporters of combustion for the production of animal heat. But starch, though a vegetable proximate principle, is not a proximate principle of the animal body, since it exists in none of the tissues. It derives its whole importance from the products of its transformations within the body, which are well known.

PROXIMATE PRINCIPLES OF THE HUMAN BODY.

Class I.—Albuminoid or Nitrogenous Elements.

FLUID.

Names.	Where Found.
1. Albumen,	found in the blood, lymph, serous fluids, muscles.
2. Fibrin,	" " blood, lymph.
3. Casein,	" " cheesy substance of milk.
4. Globuline,	" " red globules of the blood.
5. Pepsin,	" " gastric juice.
6. Pancreatin,	" " pancreatic juice.
7. Mucosine,	" " mucus.

SOLID.

8. Ostein, found in the bones.
9. Cartilagine, found in the cartilages.
10. Musculine, " " muscles.

COLORING MATTER.

11. Hæmatine, found in the red globules of the blood.
12. Melanine, " " hair, eyes, epidermis.
13. Biliverdine, " " bile.
14. Urosacin, " " urine.

CLASS II.—NON-NITROGENOUS.

1. Starch, } Changed to grape sugar in digestion, and so
2. Sugar, } taken into the blood and used.
3. Fats, 1-20 weight of men, and 1-16 weight of women.

CLASS III.—MINERAL.

1. Water, found in every part of the body.
2. Chloride of sodium, found in every part.
3. " " potassium " nearly every part.
4. Carbonate of lime, found in the bones and sometimes in urine.
5. Carbonates of soda, found in the bones, blood, saliva, lymph, urine.
6. Carbonate of potassa, found in the bones, blood, saliva, lymph, urine.
7. Phosphates of lime, magnesia, soda, and potassa, found in every solid and fluid.

The starches and sugars, from whatever source derived, are all transformed in the intestinal tract into glucose, an uncrystallizable sugar, and as such they are taken into the blood, but are not stored in the tissues as the fats are; for their proportion of heating properties is far inferior to the latter, ranking only as one to five. They and the fats are chiefly furnished, already formed, in normal food.

The third class are all minerals, and physiology requires that they also be furnished in the food—that

is, in an organized state, except salt and water, which are needed in greater amounts.[1]

The four last substances of the first class are the organic coloring matters of the body — always in small quantities, and all contain iron.

The next three are solid or semisolid, being the *organic* ingredients of the bones, cartilages, and muscles respectively. Globuline, pepsin, pancreatin, and mucosine, are the peculiar organic compounds which characterize the several fluids to which they belong.

But the first three, albumen, fibrin, and casein, are the *chief feeders of the vital parts*, and are the most concerned in the waste and reparation of tissue.

None of the fourteen substances of this class can be *crystallized*. They all *differ* in their *degree of consistency* as they are found in different parts. They can all be *coagulated*, and when once coagulated *can-*

[1] Common salt—chloride of sodium—is much more generally consumed with food than any of the other inorganic substances except water. This grows out of the part it plays in the constitution and functions of the tissues through which it is universally diffused. It adds taste to some kinds of nutritious food which otherwise would be flat and not readily taken and digested. It increases the flow of saliva and gastric juice, and facilitates the whole function of digestion. Buffaloes have their "salt licks," and all herbivorous animals thrive better with an extra amount than when kept from it. Boussingault's experiments on oxen afford proof of its necessity in their food.

The quantity of water required differs much, according to habit. Dr. Wm. A. Alcott passed a summer in active employment, with no drink saving what was in his food and fruit. Large quantities do little harm, taken under proper circumstances. But by too largely diluting the gastric juice after meals, it may thwart the anti-fermentative action of this fluid, and fermentation takes place in the stomach, and vomiting, diarrhœa, or cholera morbus result, as in hot days in summer, when large drinks are liable to be taken.

not be restored. They all are capable of exciting that peculiar chemical change, in other substances and with one another, called *catalysis*, simply by their presence; thus the intestinal fluids change starch into sugar and other forms of sugar into glucose; and thus the organic substance of muscular fibre transforms the albumen of the blood into substance like itself. All these substances, when beginning to decay, can *excite fermentation* in all other substances containing a certain amount of sugar and water. They are all subject to *putrefaction*, which is not the case with any other elements of the body, as none of them contain nitrogen.

Now, an article to be food must contain one or more of these proximate principles, or at least something that may be transformed into them. But this is not the case with alcohol. And Dr. Subbotin declares it essential to a food that it have *power to aid in the transformation of living material.* This power he denies to alcohol. Alcohol, plainly, cannot be converted into any of the third class of substances, for they are all minerals. The only change it could undergo would be to be split into its chemical atoms and produce carbonic acid and water, in which case there would be much heat, which is contrary to fact, for it lessens heat; moreover, the products of its decomposition have never been found. Alcohol has no nitrogen like the principles of the first class, neither can it answer to any of their peculiar *characteristics*, and by Liebig, and by every other chemist since his day, it has been rejected from their ranks.

Chemically, alcohol is related to the substances of the second class in containing carbon; but they all differ from it in the *manner of their transformation.* Whether they are introduced in the food, or are formed in the body and deposited, as are the fats in

the tissues, *they do not reappear in the excretions as alcohol does. They disappear by decomposition in the interior of the body, and their essential characters are destroyed; but they are not lost, for other substances into which they have been transformed take their place in the circulation, and are removed with the excretions.* There is no evidence that alcohol does or can undergo any of these changes. Hence, Dr. Marvaud and others, since Liebig, have cast it out of this class also. Even Dr. W. A. Hammond admits that *modern science expels it from the category of foods altogether.*

But, like Banquo's ghost, alcohol "will not down." Like certain street peddlers', who, rejected from the inside of the house, still stand on the doorsteps insisting on trade, so alcohol, rejected from the category of foods, still persists that it is at least

"AN ACCESSORY FOOD"

—a term invented by Dr. T. K. Chambers, physician to the Queen, and Dr. Hammond has applied to a class of substances, "which, though of doubtful or low status as aliments, are yet extremely useful, either as making food more savory, as being promoters of digestion, or as agents for developing nervous or physiological force." Under this head he ranks pepper, cayenne, mustard, tea, coffee, tobacco, etc., and alcohol in its various forms. So far as this work is concerned, we have to do only with alcohol, which, as we have elsewhere seen, differs entirely from all food substances in its chemical and physiological behavior in the body. This claim for alcohol, however, deserves notice from the name of those who put it forward rather than from any merit in the claim itself.

Leaving, then, the hoary notion that alcohol feeds the body, as being fully and forever exploded by the facts

and deductions of science, we inquire: "*Does alcohol, when taken into the system, evolve any form of force?*

The doctrine of Dr. Daniel Hooper is: "The end and aim of all food is force: food is finally converted into force; which may be regarded as its true definition, and almost as its equivalent, convertible, and equipollent term." Dr. Pavy takes like grounds. Hence, the food value of a substance may be correctly calculated by the work it will enable the system to do. Let us try this.

1. *The Body is Not the Warmer for It.*—Heat is a form of force. If alcohol be an accessory food to evolve force, it should join in some way with the second class of principles in increasing bodily heat, or in helping to resist cold. Unfortunately, the converse is the truth; its arrest of the function of the blood globules forever bars it from the claim. But, what does common experience teach?

So evident is the fact that the body cannot as well resist cold with as without alcoholic liquors, they are rejected by nearly all arctic explorers. Dr. Hayes, in 1859, would not take a man who had been accustomed to them.

Russian authorities forbid their use in the army when exposed to extreme cold. The Hudson's Bay Company banished alcohol. Arctic whalers do not use it. The bathing men at Dieppe, being much in the cold water, found spirits hurtful. "I am quite satisfied," says Dr. John Richardson, "that spirituous liquors diminish the power of resisting cold. Plenty of food and a sound digestion are the best sources of heat. We found tea far more refreshing than wine or spirits." A party exposed for a long time to severe cold and wet, found coffee, well made, half water and half sweet milk, with three or four whipped eggs added after the boiling was over, with

plenty of toast bread and good butter, served every two or three hours, to answer admirably. The men were more cheerful, and worked better than when spirits formed a part of this fare.

Rarely is there a death by freezing in New England unassociated with the bottle. The writer once introduced a medical man to give lectures on "the principles of living." But, getting drunk, he did not meet his first appointment. He afterwards gave the lectures, bought brandy with the proceeds, and perished under the snow, his empty flask being by his side.

The commander of the "Alert" reported that among the few men who escaped the scurvy, and did any sledging worthy of notice were his four men who were teetotalers.

Between Cape Travers and Cape Tormentine the distance is nine miles, and the strait, in the winter, is filled with floating ice, so that there is no communication with the mainland but by ice-boats, which are drawn over the fields of ice and floated over the open water spaces. Some thirty years ago eight men, with two boats, had gone across, and were on their return, when a bitter, blinding snow-storm burst upon them, preventing their progress. Being on a large ice-field they turned one boat up against the storm, and used the other for fuel. They had no food except their dog, which they killed and ate, and a plenty of whisky, which such parties always carry. Of the whisky, all but one drank more or less. The storm lasted four days, and when it cleared away they were drifted far towards the Gulf of St. Lawrence, but the tide was bringing them back. Now, the seven men who drank of the whisky suffered, and that just in proportion as they drank; and the only one who was able to take care of himself, and assist the others was the man who refused to touch the whisky. He

at length got on shore, procured help, and brought the others off. Some of them died outright, and others died later on, and there is every reason to believe that no one of them would ever have reached the shore if the eighth man had not been a total abstainer.

Twenty-six men were travelling over a Western plain, and were overtaken by a bitter cold night. They were without food, but had plenty of whisky. What occurred that night is related by their physician, Dr. S. E. McKinly, who, though not "college bred," was endowed with common sense. "I told them," said he, "as we can't get wood, boys, we must keep warm, or at least alive, through the powers of *Madam Vis Medicatrix Naturæ*. She is all right in any weather if we don't clog her up and pucker her forces. If I have got any medical knowledge at all I am going to use it to-night, and the first thing I begin with is this: I am as fond of whisky as any man dare be; but, by the gods, the man that gets drunk to-night, to keep warm, won't see daylight. When the Great God of the universe made man the boss workman of the earth, He made all other things first, and the elements, too, not to rule over him and to kill him, but *hunker* down to his wants. But, boys, whisky was *scored* out of that bill of fare. The *vis medicatrix naturæ* is the highest of all other things, and if she ain't *splintered* up by our own folly she will ride safe through any storm. We have got to keep stirring round or huddle up in the straw of the wagons, as many of us as can cram together. Each one will keep the other warm. We must all eat as much as possible, but whisky ain't the thing." . . .

"This is what I told them all; but very few minded me. I did not taste a drop, nor did Carter or Finley. We then huddled in together on the straw in the bottom of our wagon. We took off our boots and

overcoats, and then got on the straw, and put our blankets over us, and our overcoats on the top of them. We were only cold, but did not suffer or freeze. Clark, Riley, and Tanner were very cold, and we heard them yelling all night. They suffered very much, but were not frozen; they drank very little whisky. But they took several *thin drinks* in the run of the night. Seven other fellows, that drank a good deal, had their toes and fingers scorched, but they got over it in a few weeks. Six of the boys that drank pretty strong, were badly frozen, and never got over it; and four of them got very *boozy*, were frozen so badly that they died three or four weeks afterwards. But Hutchinson, M'Elroy, and M'Alpin, were stiff dead by daylight. They got dead drunk, and as they did not make a fuss, the other boys thought the whisky was keeping out the cold, so they drank the stronger. I tell you, sir, they all suffered just according as they took the whisky; those that got drunk froze dead; those that drank less, but too much, died after a while; those that drank only moderately will feel it as long as they live; and those that took only thin drinks were well nigh *shut up*. We three didn't drink any. The *vis medicatrix naturæ* brought us through. These men were all Americans; their ages ranged from twenty-three (M'Alpin) to forty-one (Carter). All were equally well provided, each having two blankets. All were in the bloom of life, the best of health, and ready to encounter, and able to overcome the hardships inseparable from a frontier life."

It should not be forgotten that alcohol by dilating the external capillaries *does seem to increase heat*. But this is at the expense of the interior, and internal organs suffer in consequence. Hence, attempts to get warm by liquor, are liable to cause those who use it to burn

out by fever what it were easy to have removed by drinks of hot water, hot aromatics, or hot milk, with cayenne. The last is a specially good "night-cap," the cayenne promoting sleep and bringing on perspiration and a speedy warming up of the extremities. But going to bed drunk is a most unscientific way of getting rid of a cold, for the alcohol further hinders the elimination, which is already obstructed. Dr. James Miller says: "It is practically as if the person had shut himself into a box-bed, or gone to sleep on the top of a dung-hill, or tied a cravat tightly round his neck almost to strangulation. Air gets into his lungs, but it does not do the work it is intended for there; the needful matters are oxydized imperfectly, if at all; and he is not likely, under such circumstances, to awaken refreshed."

2. *The Body is not the Stronger for It.*—Strength of body is another form of force. Seeing that alcohol utterly fails to produce heat, which, in the nature of things, it cannot do, it ought, as an accessory food, to combine with the proximate principles of the first class and increase bodily strength, or sustain the body under exhausting labors. That it does not do this, the following will show:

Dr. Christison gave great attention to the study of alimentation, and found that the system requires about three parts of carbonaceous food, as represented in Class II, to one part of nitrogenous food, chiefly albumen; and that while *nitrogenous substances may, in some limited sense, replace the carbonaceous in evolving heat, the latter can never take the place of the former in repairing textural waste;* and that the daily amount of nutritive principles of both sets must increase with exercise and exposure, otherwise the body quickly loses weight, and ere long becomes diseased. In adults this amount ranges from seventeen ounces for

prisoners to thirty-six ounces for the athletic engaged in arduous and continuous muscular efforts. Cornaro, in later life, lived on twelve ounces a day, chiefly of vegetable food, for fifty-eight years.[1] The *voyageurs* of Canada, it is stated, require a daily allowance of twelve to twenty pounds of meat.

"It seems to us," writes the editor of the *British Medical Journal*, "the clinical facts which some writers have produced as demonstrative of the food-nature of alcohol, are, as such, worth absolutely nothing. We have no hesitation in saying that *to call alcohol food, in the present state of our knowledge of its effects, is an abuse of language*. We possess no particle of satisfactory and scientific evidence to show that it is such. Those who affirm that it is should give us something beyond the mere vague surmises of their own opinions. But to say that an emaciated creature who rises from his bed, and has swallowed during his sickness large quantities of water and alcohol, is a living proof that

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[1] The late Hon. John A. Andrew, before the Committee of the Legislature, in Massachusetts, having referred to Cornaro as though "light wines" had much to do in supplementing his solid diet, I find that Dr. Carpenter ("Human Physiology") makes no reference to this use, and he cannot be quoted as supporting the idea that wine was an important part of Carnaro's food. Cornaro died at Padua in 1566, at the age of one hundred and four. In his early life he indulged in strong drink, and deranged his digestion so that from the age of twenty-five to forty he had a disordered stomach, with the gout, and slow fevers till his health was badly wrecked. By the good advice of his physician he abandoned his dissipations and began a most abstemious life, which he afterwards followed, realizing its attendant blessings to body and mind. "His diseases vanished," says his biographer, "and gave place to a state of vigorous health and tranquillity of spirits, to which he had hitherto been a stranger." Cornaro composed four treatises on "The Advantages of Temperate Life."

alcohol is food, is manifestly an unfounded assumption."

To the common claim that *alcohol promotes digestion*, it need only be said that Drs. Todd and Bowman observe in their "Physiology," "that such is the action of alcohol on animal tissue that if a glass of grog were taken after a meal of mutton-chop and retained in the stomach, that the chop would never be digested." In such cases digestion is delayed till the spirit passes out of the stomach, after which the organ goes on with its work. Dr. Beaumont *saw* just this state of things in the stomach of Alexis St. Martin. Küss ("New Manual of Physiology") asserts that *an aliment is the proper stimulant for the stomach.* Pebbles, swallowed, provoke a flow of mucus, but not the secretion of the digestive juices; the mucus hinders, and does not help digestion.

Food, delayed in the stomach by the presence of alcohol, would, without doubt, at times give a sense of comfortable fulness, as though doing good. Thus easily-digested food becomes "hearty," like "bacon and eggs," so that the liquor appears to be strengthening. If I take a meal of tripe, which ordinarily digests in one hour, and follow it with a glass of liquor, which thwarts its digestion for three or four hours, I practically take a "stone" for the two or three extra hours. The tripe was food, but, hindered in its transformation, it remains in the stomach as a foreign body. Dr. Subbotin made numerous experiments, and concluded that *alcohol is only an excitant, and cannot be regarded as in any sense a food.* This is also the opinion of Dr. John Marshall in his "Physiology."

M. Morache, a French writer, observes: "*Its prolonged use becomes a sense of weakness*, because the nervous system becomes deranged by successive excitations, then falls into a state of torpor, from which

it becomes no longer capable of recovery." The repeated irritation of the digestive mucous membrane destroys its functions, the sense of hunger is assuaged, nutrition impoverished, and the whole organism falls into a state of marasmus or nutritive starvation and decay. Whether it *strengthens*, Dr. C. R. Chambers states that "*it seems very doubtful if, on the healthy nervous system, this is ever the effect of alcohol, even in the most moderate dose, and for the shortest periods of time.*" Dr. A. Mullan asserts that the popular belief that beer or other alcoholic drinks is strengthening, "is a mistake, a delusion, a mere superstition, which receives no support from science." Kimmerich, of Germany, declares that "it is now known that wine is not a food."

Dr. Parkes (*London Lancet*, 1872) made the most perfectly controlled experiments ever published. For three days he put a man to hard work, and gave him four ounces of brandy at 10, 2, and 6 o'clock, or 5.4 ounces of absolute alcohol a day. The most remarkable feature of this experiment was the effect on the heart, hindering him in his work. The first dose disturbed him but little, the second made him thirsty and brought on palpitation. On the third day, the *strengthening beverage* wellnigh used him up, and he was obliged to stop from time to time, "his breathing was so short."

Exactly does this tally with von Liebig: "The circulation will appear accelerated at the expense of the force available for voluntary motion, but without the production of a greater amount of mechanical force. It is attended with an inward loss of power, which ceases to be productive in working." Dr. Brinton writes: "Careful observation leaves little doubt that a *moderate dose of beer or wine* will, in most cases, diminish the maximum weight a per-

son can lift." Hence, to our mind, the attempt by some to apply a principle of mechanics and convert heart-beats into foot-pounds is a total failure, assuming, as it does, that increased frequency of pulse is equivalent to increased strength, which most certainly is not the case. Prof. W. E. Ground, of Toledo, asserts that it does not have even "a primary stage of stimulation; *that it acts as a paralyzer from the first through paralytic effect on the nerve centres*" as if the inhibitory nerve were cut and the heart beats faster, just as in experiments of this sort on animals, so that the physical power to resist external forces is diminished from the start.

But what is the testimony of common experience? Wallace Ross, the strong Scotchman, took no malt liquor, considering it bad. "Lager was very bad." His diet consisted of good food and tea, the latter being his "greatest stimulant." Rice, chicken, and tea comprised the chief food of Prof. Oscar Lenz in a journey on foot nearly across the African continent, and all the while he enjoyed excellent health. Benjamin Franklin was an abstainer, and had superior strength to his comrades. The Olympic feats were performed without alcohol. Nearly every modern prize-fighter discards the intoxicated muscle as also tobacco. But Bacchus, jealous of the "belt," is "knocking out" the world's great champion." E. P. Weston, "the walkist," regards liquors "not only not necessary, but wholly injurious." Hector's mother besought him to take a little wine when weary fighting for his friends, but he replied: "Bring not the sweet wine to me, my venerable mother, lest thou unnerve me and I lose my strength and resolution," showing that the weakening power of alcohol was known by Homer. A nail-maker, after five years total abstinence, "found hard work easier, and long

hours more readily endured." "Our people," says Buffalo Bill (Col. W. F. Cody), "are abstainers generally; their hazardous work requiring complete self-possession at all times." All the great marksmen of the world are abstainers. Said a London coal-whipper: "I have backed as many as sixty tons of coal a day with perfect ease since I took the pledge. But before, I should scarcely have been able to crawl home; certain to have lost the next day's work." An abstaining fire-brigader endured when all the rest were "beat and fell away." Thirty-four hard workers certified: "We, having practised total abstinence from one to ten years, testify that we are all able to perform our toil with greater ease and satisfaction to ourselves than when we drank moderately of liquors; and our general health and circumstances have also been considerably improved." Indeed, wherever tried the experience of hard workers runs about thus: We can do more work; we can do it with greater ease and comfort to ourselves; we are less fatigued at night, rest better, and are better prepared for the next day without than with liquor. This is the drift of all experience in the army, on the sea, or in private life. Science shows and experience demonstrates that liquor cannot strengthen, but, on the contrary, actually depreciates the strength one naturally has.

3. *Alcohol Does Not Help the Mind.*—As the muscular system acts as it is acted on, it becomes exhausted only when the brain and nervous system are exhausted. Now, if the brain, under alcohol, loses power to move the muscles, will it not also lose power to think from the same cause?

Drs. Carpenter, Miller, and others, having ably answered this question, I will simply introduce a few illustrative instances. Dr. Anstie tried a small dose on himself, and his thoughts became confused. Of

its influence, he says: "The early phenomena of alcoholic intoxication usually wear an appearance at first sight much resembling excitement. But on analyzing the symptoms, we are at no loss to perceive that it is the *emotional and appetitive part of the mind which is in action, while the intellect, on the contrary, is directly enfeebled.*" This accounts for the fact that we sometimes have drunken poets, but never drunken philosophers.

Dr. Brinton considers that "mental acuteness, accuracy of perception, and delicacy of the senses are all so opposed by alcohol that the maximum efforts of each are incompatible with the ingestion of any moderate quantity of fermented liquid. A single glass will often suffice to take the edge off of both mind and body, and to reduce their capacity to something below their perfection of work."

So Homer understood it when he made his hero say:

> Far, hence, be Bacchus' gifts, ——
> Inflaming wine, pernicious to mankind,
> Unnerves the limbs and dulls the noble mind.

Sidney Smith was a moderate drinker, but reformed, and, after a year's total abstinence, wrote Lady Holland: "Many thanks for your kind anxiety respecting my health. I not only was never better, but never half so well. Indeed, I find that I have been ill all my life, without knowing it. Let me state some of the good arising from abstaining from all fermented liquors: First, sweet sleep, having never known what such sweet sleep was. If I wake, no needless terrors, no black visions of life, but pleasing hopes and pleasing recollections. Secondly, I can take longer walks, and make greater exertions, without fatigue. My understanding is improved, and I comprehend political economy. I see better without wine and spectacles than when I used

both. Pray, leave off wine—the stomach quite at rest; no heartburn, no pain, no distension."

Bishop Lightfoot, of Durham, abandoned drink, and found the change so gratifying that he believes it is the way all should live. He sleeps better, and can work better than when he drank.

Rev. Stopford A. Brooke, a moderate drinker, reformed and testified to the happy change. He works better; has greater command over his powers to use them when he pleases; the pleasures of life have increased like a renewal of youth. Even small quantities of liquor injured the fineness of the physical balance—the state of health in which all the world is pleasant. Thus is confirmed what Drs. Beddoes, Baer, and Donders assert: that alcohol is no savings bank for either muscular or mental strength.

Canon Farrar was also a moderate drinker, but is radically reformed. His sacrifice to do so is put as follows: "I was not giving up an element of food—because I have found, since I became an abstainer, that I also take very much less food, and that meat once a day is amply sufficient. I was not giving up any source of strength, for I found my endurance was very much greater than before. I was not a whit less inclined to be happy and mirthful than those about me, and I have always felt a certain amount of contempt for the poor kind of cheerfulness which requires a chemical ingredient for its sustentation. Neither was I giving up a cause of happiness, for since I have taken the pledge I have been at least as happy and healthy as before." He has gained a great deal, and can do both physical and mental work, impossible for him to have done while he indulged.

Drinking convicts always improve mentally and physically immediately they are locked up and separated from their cups.

But why refer to men who have found the gain only after their reformation? *Why not learn from example, and recognize the gain men have received who have never indulged?* Solon told Crœsus that happiness was to be calculated only by including the whole of life. The whole life given to total abstinence must be the basis for judgment of what is gained by abstinence or lost by indulgence. That great body, the Methodist Church has been under a total abstinence discipline from the days of its founder, and during all its history has produced men who have made their mark and blessed the world. Who can imagine Charles Wesley vying with the Psalmist in melody, and yet

bousing at the nappy?

Burns, and Byron, and Poe might "bouse" and sing, but they did not tune their harps to the key of David, nor did they live to sing in old age, like Wesley and Watts, who did not "bouse." How preposterous to think of John Fletcher sweetening his spirit on cider! Of Adam Clarke increasing his store of knowledge over the nappy! Of John Wesley, Whitefield, Asbury, Simpson, Foster, and hosts of others, speeding their mission by a Pegassus dependent on the saloon! The height they reached could never have been attained but by total abstinence, and that from the outset. The life, health, and general prosperity of the thousands in this country and in Great Britain who do not indulge, is argument positive against the waste of physical and mental energy by drink, and speaks to every one as Pat wrote his brother concerning coming to America: "If yo're not started, go back."

4. *Alcohol as a Solvent of Food.*—But may not alcohol aid by dissolving some things more readily than

water, and so promote assimilation? We have no reason to believe it. Both the physiology of alcohol and the processes of digestion are against it. In any appreciable quantity alcohol lessens the flow of the gastric juice, and precipitates its pepsin, and coagulates albumen and fibrin. If, in some measure, it breaks up certain oily elements, they cannot be absorbed till they get below the stomach. Though it dissolve resinoid substances out of the body they are at once precipitated on entering the stomach; and were it possible for them to pass into the blood in solution in the spirit they would need its presence for their continued solution. Besides, what tissue wants them? Alcohol is not itself incorporated, and how can it incorporate anything else? Substances requiring unnatural means for their digestion cannot fill the place of food. So evident is this that Baron Liebig asserted that even "those constituents of meat which are soluble only in boiling water take no part in the renovation and formation of muscular tissue."

Dr. Mackinnon (*Canada Lancet*) goes further, and denounces as not only unnecessary, but absolutely injurious, under the ordinary circumstances of life, artificial preparations—as extracts of meat, concentrated milk, infant's food, chemical food, and the like." While Dr. Le Bon (*Med. Times and Gazette*, 1880) declares that all elixirs or wines sold, containing any of the essential principles of blood or meat, are an entire delusion, as they cannot contain one atom of the albuminoid principles which give meat its nutritive properties. *Water*, or water with the various acids and alkaline fluids of the body, *is a universal solvent of the body*. There is no other fluid that can take its place. When deprived of water the system suffers more than from the privation of

food. Of the latter, the tissues have a reserve, but not of the former. Hence, the conclusion of Dr. Carpenter: "Alcohol cannot answer any one of those important purposes for which the use of water is required in the system, and that no substance can become a part of the body, which requires alcohol for its solution."

5. *Other Considerations.*—Of the food value of liquors, we can adopt as our own the words of Dr. B. W. Richardson: "There is no evidence, at any stage, that there is increase of power in the organism. The overwhelming fact of the reduction of temperature following their use quite puts out of the question any chemical consumption of them within the body to any amount." And were alcohol really changed in the system, and were it possessed of a food value (for which there is nothing to show), then we have to meet the statement of Prof. Voit, as also that of Dr. Subbotin: "Since alcohol, when taken in considerable amount, causes disturbance in the processes of the animal economy, we cannot introduce it in quantities sufficient for nourishment as we do other nutriments, *and in the amount which we can take without injury its importance as a nutriment is too small to be considered.*"

But if, notwithstanding all this, there are those who still believe in the food quality of liquors, particularly of beer as a *cheap food for the poor*, let them try a little arithmatic. We have seen that one bushel of barley produces 20 gallons, or say 400 drinks of beer. This at five cents a drink makes the barley cost $20 a bushel. When the poor pay 15 cents a quart, the usual price for beer, they pay $12 a bushel for the barley. It is to be remembered that an effort was made in the manufacture of the beer to rid it, as far as possible, of all nutritious qualities, so that, according to Liebig, it requires 730 gallons of the best Bavarian

beer (36½ bushels of barley) to equal in point of nourishment a five pound loaf of bread or three pounds of steak. Thus this charitable advice for those who cannot afford meat and bread for their families, requires them to pay $438 for less than 50 cents worth of common bread and $146 per pound for the steak.

The editor of the *London Lancet* being asked whether there was any other drug, or any modified plan of diet, that would enable persons, who are necessarily subjected to the strain of life in London society, entailing, as it does, an insufficient amount of sleep, to dispense with the use of alcohol at night, answered that the question was serious, and the reply must be in an almost unconditional negative. The question involves the problem of getting an utterly abnormal amount of work out of the nervous and muscular systems. But force cannot be created out of anything except nutrition, and there is a limit to this. To overdraw in this direction is to draw on one's physical capital and bankruptcy must ensue; for there is nothing truer outside of the body than in it. "It is," says he, "for the respectable matrons of Belgravia to say which of these courses they prefer to take: they can, if they please, reduce the strain which they at present throw upon their daughters' energies, and enable them to live in the way which alone is physiologically suited or æsthetically appropriate to healthy maidens, viz., with little or no alcohol; or they can educate the young ladies to eat a great deal more food than they do at present; or they may continue the present state of things, which involves an inevitable and not very small percentage of such excess as suffices, at least, to rob female life of its poetry, its enthusiasm, and its refining influence over mankind. Such is the choice presented to the matrons of our immaculate British Society."

We have seen that the claim that alcohol conserves tissue is fallacious. Of the same piece is the statement of Moleschott: "who eats little and drinks moderately of alcohol retains as much in his blood and tissues as he who, in corresponding relations eats more and drinks neither beer, wine, nor brandy. Another claim for alcohol is that it is a *restorative* after great exertions, especially when proper time cannot be had for either food or rest.

It is confessed that a drink of liquor at such times seems agreeable both by its excitation of the heart and its anæsthetic effect upon the aching muscles. But, as Dr. Parkes shows, the effect of the spirit on the heart is exciting, not strengthening, and compared to that of a spur to a horse, quickening its movements for a time, but not increasing its strength as a feed of corn would do. Recent experiments at London show that alcohol may temporarily increase the frequency of the heart beats as much as one-fifth, but it no wise improves the tone. Death follows with pulmonary congestion and nervous prostration all the same. But there is no need that a questionable agent should be resorted to when restoratives are demanded. Hot water and milk and water answer very well. Milk is greatly to be preferred, especially after loss of blood. So the Scotch physicians have found it. In my experience it has yielded excellent results on many occasions.

Coffee is a decided restorative. Several portions of our late army so found it. From the time of the elder Larrey, Napoleon's great surgeon, efforts have been made to introduce it into the French service as a substitute for alcohol. Surgeon-General of the British Army C. A. Gordon, remarked: "Without doubt, its universal adoption would be a great boom to all armies, and the great benefits obtained from it under particu-

lar circumstances are willingly allowed." Tea and cocoa do quite as well.

A late debate ran through several numbers of the *Deutsche Medizinal-Zeitung*, and was closed by Herr Mehlhausen, who referred to the extended observations made in the Prussian army on serving rations of schnapps to soldiers in active service. Thorough experiments had been made by the surgeons which led them to abandon spirits for tea and coffee. But none of these things can for any length of time take the place of

Tired nature's sweet restorer—balmy sleep.

Hence Dr. Hammond does well to say: "To transgress the laws of our being, in the employment of these substances leads just as surely to punishment as the violation of any other sanitary or physiological statute. If the offense is slight, the punishment is proportionally small; but he who outrages the laws which govern his organization meets with inevitable retribution, sooner or later."

III. ALCOHOL DOES THE BODY HARM.

A food in any proper sense, though we might not understand its physiological evolutions, should, at least, do no harm. But the whole physiology of alcohol lies against it, for, as we have seen, its predominant nature is to do evil, and evil continually. To this a slight showing only will be given. "Health," says Dr. Sir Andrew Clark, of London, "is the loveliest thing in the world." From this even small doses of alcohol will take the bloom, injuring its perfection of loveliness both mental and moral. Of his cases in the London hospital, 70 per cent. are due to drink—not necessarily drunkards. "A terrible responsibility," he says, "lies upon such as forget the plain and certain teachings yielded by the commonest

experience, and stimulate people to keep them up with glasses of wine and glasses of beer."

"I have no hesitation," says Sir Henry Thompson, "in attributing a very large proportion of some of the most painful and dangerous maladies which come under my notice, as well as those which every medical man has to treat, to the ordinary daily use of fermented drinks, taken in the quantity which is commonly deemed moderate."

Dr. T. K. Chambers asserts that a small amount of alcohol taken regularly may do great damage and really interfere with the functions of the stomach. In his work on "Indigestion," is the following: "When a considerable interval intervens between the indulgences, and the reaction is allowed to have its way till ordinary digestion is restored, the constitution may very often be still uninjured. But I *have not yet met with a forenoon tippler, even though he never got drunk in his life, without a condition of stomach which must inevitably shorten his days.*"

Dr. Chambers, in his earlier days, wrote more favorably of alcohol than after maturer observation, hence he has been quoted as an authority for drink. We therefore produce a few extracts from his late work, "Lectures on the Renewal of Life," to make sure of the import of his maturer ideas. "The constant presence of alcohol in the blood obstructs the necessary renewal of the fibrous capsule of the liver; contraction of the degenerate tissue ensues; the portal blood cannot pass through the viscus to get rid of its effete particles, or to bear the nutriment to the general circulation."

"The mixture of alcohol and sugar, such as we find in beer and sweet wines, makes a deleterious drink" for persons inclined to corpulency.

"When the marked feature of a disease consists in

retention of effete matters which ought to be discharged," he says, "abstain from the use of alcohol altogether." He always found the effects of alcohol injurious to uræmia, to jaundice, and usually the uric acid diathesis. "Children recover quicker without wine"—a fact quite universally accepted.

"In the administration of alcohol under any form, *a rule directly opposite to that which governs the giving nutritious food should be observed.*"

"A very small quantity is an emetic" in certain cases of pregnancy. "Foolish women sometimes take an additional quantity of wine or beer at this time, and are punished by troublesome vomiting," of which the cure is "to leave it off and take only light digestible food."

"Nothing is so injurious to degenerative tendencies as alcohol, and no form of alcoholic liquid is so bad as beer."

"In my opinion alcohol is not only useless, but injurious to the consumptive."

"It arrests and obstructs vigor of vital action. Under its use renewal goes on slower, as we know by the diminished excretion of urea, water, bile, etc."

"We, therefore, can hardly expect it to be advantageous where the continued renewal of vital powers is our primary object."

With this accords the personal experience of Dr. Trimnel, of Secunderabad, India. He thought he could not get through his excessive work without stimulants, he passing as a temperance man, and "never known to be the worse for liquor." Being converted to God and becoming a total abstainer, his nerves, muscles, and brain greatly improved, and he made a clear daily gain of two hours in effective work.

Dr. James Miller, the great Scotch surgeon, states:

"So far from retarding waste, it hurries it on; so far from favoring, it opposes the power of nourishment and repair. Alcohol does not contribute one solitary brick to maintain the wall of the animal economy; nor does it at all retard the spontaneous crumbling of it. On the contrary, it both enlarges the existing breach, and thwarts the masonry that would fill it up. He is surely an unwise builder, who uses so distempered a mortar."

There is another subject which claims a moment here.

In his "Treatise on Hygiene," Dr. Hammond gives as the chief reason why the advocates of a total prohibition of the employment of alcoholic liquors have not been able to carry conviction to those whom they address, "that their remarks have mainly consisted of invectives, and that whatever facts they have brought forward have been altogether based upon the immoderate use of the agents in question." Yet in the very next sentence he admits all that is claimed against their immoderate use; that the moderate use of spirits by healthy persons is attended with ill-effects, varying according to the quantity, condition, and temperament; that wine, porter, ale, etc., when used in excess, lead to results decidedly abnormal in their character.

As to "invectives," our wide reading makes it sure that they are mostly on the other side, and I am sorry to say there is no occasion to go far from Boston medical writers to find illustrations of this. But in reference to the "immoderate use" of liquors, would Dr. Hammond have us forget the *law of increasing habit*—that large tippling always follows, never precedes, small tippling—and that a threefold cord binds the moderate with the immoderate use of spirits; and that the countless drunkards, both in their graves and

on the way, were once only moderate drinkers? On such facts there are ground for "arguments," and he counts too much on human nature who forbids them. The fruit declares against the tree that bears it. And though some may tamper with strong drink and apparently escape unharmed, so many of the great, the good, the learned, have gone down under the law of habit, it is not—it cannot be—wise to expose ourselves or others to a law which has reaped such fearful harvests.

In concluding this section, how eminently fitting are the words of the late Prof. E. A. Parkes, who having gone over the whole subject of "alcoholic beverages" in his "Manual of Practical Hygiene," and having, most critically, examined every phase of it, especially in reference to its use by the soldier, raised the question, whether there were any circumstances in a soldier's life in which the issue of spirit was advisable? or which was better, the issue of spirit or total abstainence?

This is his reply: "To me there is but one answer. If spirits neither give strength to the body, nor sustain it against disease — are not protective against cold and wet, and aggravate rather than mitigate the effects of heat—if their use, even in moderation, increases crime, injures discipline, and impairs hope and cheerfulness—if the severest trials of war have been not merely borne, but most easily borne, without them—if there is no evidence that they protect against malaria or other diseases—then I conceive the medical officer will not be justified in sanctioning their issue under any circumstances."

And if a medical officer cannot be justified in issuing them to the soldier, who, being deprived of so many other things, more especially needs the comforts of alcohol, if any it has, we may most emphati-

cally ask: How can a Commonwealth justify itself in issuing them by license, or otherwise, tacitly sanctioning their sale? Surely, a thing whose evil is so overwhelming is fit for neither military nor civil life, and should by no means be tolerated by any person or community.

A Medical Mosaic.

J. W. Beaumont, M.D., L.R.C.P., Edinboro'.

I have treated several thousands of cases of all kinds occurring in general practice without alcoholic liquors of any kind. The medicines take effect more potently, and answer their end better. Patients get well much sooner, and, as a natural consequence, my bills are considerably less.

Henry Mudge, M.R.C.S.

I saw scores and hundreds arrested by abstinence in their downward course, but of these not a few were set moving again, towards the abyss, by medical advice. I thought I would do with as little as possible of alcoholic stimulants. The result of these trials was decidedly in favor of abstinence, and consequently liquors have legitimately disappeared from my list of medicines.

John Higginbottom, F.R.S., F.R.C.S.

I gave alcohol in my practice for twenty years, and have now practised without it for thirty years or more. My experience is that acute disease is more readily cured without it, and chronic diseases much more manageable. I have not found a single patient injured by its disuse, or a constitution requiring it; indeed, to find either, although I am in my seventy-seventh year, I would walk fifty miles to see such an unnatural phenomenon.

DR. CHEYNE, Dublin, Physician to the Forces.

The benefits which have been supposed from their liberal use in medicine, and especially in those diseases which depend upon mere weakness, have invested these agents with attributes to which they have no claim, and hence we ought not to rest satisfied with the mere acknowledgment of error, but we ought also to make every retribution in our power for having so long upheld one of the most fatal delusions that ever took possession of the human mind.

SECTION III.—ALCOHOL AS A MEDICINE.

Seeing that alcohol, habitually used, is of the nature of a slow poison working most marvellous changes in the organism tending to its destruction, and seeing that it is not a food—all claims that it is being in the face of all known chemical and physiological principles and the accumulated evidence of experience—the inquiry remains whether it can rank as a medicine, and, if so, to what extent and under what circumstances.

I. THE TERM MEDICINE TO BE RESTRICTED.

This term applies to both the art and the agents used in combatting disease, and in both senses is too broad and confusing, widely varying from the beautiful aphorism of Dr. James Rush: "Exactitude of knowledge is the bright felicity of intellect."

1. *Medicine as an Art.*—It embraces all shades of the so-called "pathies" or "modes" of practice, up to where mental training and conscience take hold on facts, after which we may adopt the happy definition of Prof. Wallace: "The practice of medicine is the practice of common sense."

Truth is truth forever. No matter where found, or how developed, all real facts of diseases and remedies

are destined, some time, to be appropriated and become a part and parcel of rational, scientific medicine. Superstitions and assumptions must give way before the rising sun of knowledge, when it will be easier to judge correctly of ailments and what is to be done for their relief.

The "method" which rigidly scans the facts of both and therefrom rationally deduces means to ends, is fast discarding baseless notions and harmful remedies. Alcohol is suffering in this ordeal, and many acute minds are coming to believe with Dr. Gairdner, that "this agent will ere long be regarded as entirely unscientific in acute diseases, while, for chronic troubles, it will have no place." No respectable writer to-day gives it place in other than exceptional cases. Some reject it in toto, not only from its physiological unfitness, but because if allowed "an inch it will take an ell." Dr. Henry Leffmann condemns it on scientific grounds, and, turning the tables on those who prescribe it, makes them responsible for a large proportion of the misery it occasions, and declares the time come when the profession should take a stand for abstinence. Years ago, Dr. R. D. Mussey insisted that so long as alcohol retained a place among sick patients so long would there be drunkards.

How great the change in our ideas has come to be one has but to read the following statements on whisky in our medical mother tongue of 1577: "There is used an ordinary drinke of *aquæ vitæ*, so qualified in the makyng that it dryeth more and inflameth less than other hote confections. One Theoricus wrote a proper treatyse of *Aquæ Vitæ*, wherein he prayseth it to the ninth degree. He distinguisheth three sortes thereof—*simplex*, *composita*, and *perfictissima*. . . . '*Beying moderately taken*,' sayeth he, 'it sloweth age it strengtheneth youthe; it helpeth digestion; it cutteth

fleume; it abandoneth melancholie; it relisheth the harte; it lighteneth the mynd; it quickeneth the spirites; it cureth the hydropsie; it healeth the strangury; it pounceth the stone; it repelleth the grauel; it puffeth away ventositie; it kepyth and preserveth the hed from whyrling—the eyes from dazelyng—the tongue from lispyng—the mouthe from snafflyng—the teethe from chatteryng—the throte from ratlyng—the weason from stiefling—the stomache from womblyng—the harte from swellyng—the bellie from wirtchyng—the guts from rumblyng—the hands from shieuryng—the sinowes from shrinkyng—the veynes from crumbling—the bones from akyng—the marrow from soaking.' . . . And trulie it is a soveraigne liquor if it be orderlie taken."—*British Medical Journal*, June 14, 1873.

2. *Medicine as Applied to the Agent Use.*—It is any substance, solid or fluid, from the three kingdoms of nature, having the power to cure or alleviate disease. Poisons even, in the hands of intelligence and skill, are made beneficial to the sick. But to be a medicine, in the proper sense of the word, the substance must come within the three following requirements:

(1) *It Must do Its Work in a Reasonable Length of Time.*—When Dr. L. B. Coles wrote on tobacco, he stated that there were two usual ways for administering medicines—externally and internally—but when tobacco was prescribed it was used *eternally*. Now a substance which cannot be left off after a time, but begets a demand for its continuance, and makes the last state of the patient worse than the first, is outside of rational medicine and dangerous. Alcohol taken *eternally* is not a medicine.

(2) *It Must Have Appreciable Action of Its Own.*—When an interne at the hospital the writer was di-

rected to give a bread pill for a cathartic, and got results. But these results were not due to any such properties in the *pill panis* itself, but wholly to the imagination of the patient, who, having become accustomed to a cathartic pill, received this pill as he had the others. A drop of water or a bit of sugar would have done as well under like circumstances. The power was not in the pill but in the unconscious influence of the mind over the bowel functions. Ignorance on his part was the ground of his imagination, while knowledge would have dissipated the delusion and destroyed the effect. But ignorance on the part of those to whom we minister cannot be the general ground of an honorable practice.

Imagination, as to the value of alcohol, has given it its potent charms and been the mother of its use. But so far as alcohol produces its effects through mere superstition as to its power and not through virtues of its own, it is not a medicine, in the strict sense of the word; it is a cheat, and a *standing cheat*, though serving the purpose of quackery, *can never be approved by an intelligent people.*

(3) *Its Action Must be in the Line of Its Physiology.*—The very able French author, Gubler, lays down that "an agent acts in a similar manner on both the healthy and the diseased body. The curative effects of any one substance result from its physiological action." Hence nothing could be more absurd than the statement once made to me by a flourishing "pothist." "You must remember, doctor, that a little *Sal Nat.*, taken as a medicine, acts very different from a little common salt taken as food."

Now the great advancement modern medicine has made in exactness has been by first experimenting with drugs on animals, then on healthy persons, and lastly, with the knowledge thus derived, cautiously

administering them to the sick and noting all effects. This working up of knowledge, it is safe to say, has done more to establish definite ideas than all the theories ever invented.

Following the principle laid down by Gubler, we get rid of a large part of the fancies about alcohol, and are reduced to comparatively narrow limits in its use which its physiology teaches us should be the case.

II. ALCOHOL AS AN EXTERNAL REMEDY.

The properties of alcohol show us that it may answer many useful ends, when externally applied, and not be liable to most of the drawbacks attendant on its internal administration.

1. *As a Refrigerant.*—Absorbing much heat in its rapid evaporation, it is cooling to parts to which it is applied, if under favorable conditions for the evaporation. Weak or strong, alone or mixed with camphor, ammonia, ether, chloroform, or other substances, its application is often very agreeable. In the various superficial inflammations, and in general febrile movements, its effects are salutary. When poured on the exposed part in "caking of the breast" in nursing women, nothing is more effectual, especially when it is pure and strong. When diluted and burned under a person in a chair well covered in, after the manner of the "rum-sweat," it lessens febrile tension, and apparently does good. Yet this use of it must be conducted with care, since it has probably killed more than it has cured. Dr. W. B. Carpenter himself, who wrote so ably on alcohol, so lost his life from the clothes taking fire.

2. *Alcohol as an Excitant.*—Here is also a field for the good effects of this agent in exciting the skin; but it is commonly used with camphor, aconite, tur-

pentine, ammonia, etc. Water alone seems to depress the surface in some persons, especially women, while if alcohol, ammonia, or common salt be added, they can take their needful baths without fear of neuralgia. In certain relaxed conditions sponging with alcohol closes the pores and diminishes excessive sweating. The great sympathy between the skin and internal parts renders its occasional external employment of advantage to internal disorders. So it may aid digestion, or be a tonic to the spine of weakly children. Serviceable as it may be, there is objection to the free use some French physicians make of it in wine poultices, for Hirtz has known such use to beget a desire for strong drink.

3. *Alcohol as an Anodyne.*—As such it serves useful local purposes, mitigating pain, as in bruises, sprains, etc.; relieving restlessness; allaying sensitiveness of the skin, and the distress of neuralgia. When combined with turpentine and chloroform, it is efficacious in various deep-seated pains. Even so severe a disease as sciatica has been kept bearable by it till other measures could effect a cure. With aconite, arnica, camphor, belladonna, witch-hazel, etc., it often eases distress. It mitigates the smarting, burning pain of erysipelas. But here its cooling effects are dangerous. I once carried a scrofulous child through an attack of erysipelas of the face and head. Some weeks later, it returned in the same parts when a granny undertook to treat it. She applied rum and drove the inflammation down upon the membranes of the brain with fatal consequences.

4. *Alcohol as a Styptic or Astringent.*—The great French surgeon, Nélaton, was in the way of washing out fresh wounds with it to stop the bleeding before bringing the parts together. My friend, the late Dr. J. B. Treadwell, of this city, did the same. I have

myself obtained most excellent results in this way. The strong alcohol checks the flow of blood and lymph and so dries the parts that they can be at once coaptated without the usual appliances for drainage, and the healing is likely to be complete throughout. So large a wound as that, after removal of the breast, I have healed perfectly in this way. Dr. J. L. Suesserott binds up wounds in whisky and keeps the dressings wet with it. Spirits were so used extensively by the French surgeons in the late Franco-Prussian war. Some of its good effects are, however, doubtless due to its decided antiseptic quality. Some have suggested it for toothache. But Celsus, at the beginning of the Christian era, forbade the use of wine by persons accustomed to it, when afflicted with pain in their teeth. Weak alcohol is serviceable in inflamed eyes. When applied strong to injured parts, care is to be taken not to let it get beneath the dressing. Several painful cases of this accident have come to my knowledge. Like other strong agents, it requires judgment even in its external application.

The foregoing suggests some of the indications this agent may serve when skilfully employed, they being in the line of its physiology. But it is in nowise a necessity, for the abundant recourses of surgery to-day easily supply all needed substitutes. Hence, however serviceable or convenient it may be as an external remedy, this should not in the least stand in the way of its total suppression any moment, other reasons require its removal.

III. ALCOHOL AS AN INTERNAL REMEDY.

This subject is not so easy. The complex circumstances and the nature of the agent render its action less simple and pure. And in the absence of our present knowledge of its physiology and the law of med-

ical agents Gubler lays down, former physicians saw it in the distance where, like an object seen through a mist, it took shapes and proportions as inclination and fancy determined; and never, since the days of Babel, has anything else sent such confusion into human thought and language.

1. *The Alcoholic Muddle in the Medical Mind.*—The "eminently incautious" Irish physician, Dr. Todd, was fully captivated by it and surrendered his patients to it without reserve. Dr. Carpenter, with greater learning, regarded it an enemy to be shunned; M. Lunier, the same. Chambers advised its use in one or two large doses a day, but only in the afternoon; it was poison in the morning. Most physicians doubt, yet dare not let it alone; and singularly enough the more desperate the case, the more likely are they to resort to this questionable drug, till confusion is worse confounded. Prof. Roberly Dunglison said "the case must be bad indeed in which the hopes of the practitioner are placed on the excitement alcohol is capable of inducing. It may be a great question whether it be not calculated to exhaust the slight amount of excitability still existing in the system."

The late Dr. Geo. M. Beard was led to regard this confusion as not so much due to any want of discrimination of its physiological action as to the capriciousness of the drug itself. In his view, "so capricious and uncertain are the effects on different individuals, that physicians when they prescribe liquors for the first time to a patient with chronic disease, usually feel that they are trying an experiment. Sleep and wakefulness, headache and relief of headache, flushing of the face and feeling of heat in the extremities, indigestion and relief, and prevention of dyspeptic symptoms, constipation and looseness, fat and emaciation, strength and weakness, stupidity and hilarity—all

this vast variety of opposite symptoms may and do result in different constitutions from the use of alcoholic liquors, and that, too, from the weakest as well as the strongest forms, whether used in large or small doses. In the long run, they bring on more disease than they prevent or relieve, and *in every way work more injury than benefit.*"

This confusion is further increased in our day of supporting measures, in conceding foodful qualities to liquors, whence they apply both to the sick and to the well. Especially is this so with beer, which is styled "the milk for the aged"—an expression by Liebig in his early writings, but substantially confuted by his maturer thoughts, as my quotations from him show.

But this species of discrepancy is not confined to Liebig, but is in all learned writers on this subject whose writings extend over any considerable number of years. Thus Chambers, Anstie, Brinton, and others lost confidence in it as years went by, and it is not fair to quote their earlier and immature expressions against their great names to the neglect of their more mature deliberations. But this was the capital sophistry of the late Hon. John A. Andrew, in his most specious plea in behalf of the liquor interests of this State—a plea all the more deceptive because so few knew the falseness of his positions so as to avoid his conclusions. But as this expression of Liebig's, though refuted by himself, is so taking, I stop to introduce a few witnesses to show, from another source, its absolute unsoundness.

A friend of mine is eighty-six, sprightly, with steady nerves, a good voice to sing, and with all his other faculties finely preserved. "I attribute this," said he to me, "to the fact that I never drank or used tobacco. I use tea and coffee sparingly, but am very

fond of milk, which is my principal drink. I had bread and milk for my breakfast this morning."

Dr. L. L. Silverthorn's father died at eighty-seven, and his mother at ninety-five, "and their bodies were not poisoned by alcohol." He has totally discarded it in his practice.

Four brothers live in Hightower, Ga., aged seventy-nine, seventy-seven, seventy-five, seventy-three. They were never drunk, never took a drink in a bar-room, and never played a game of chance. They had thirty-four children, sixty-one grand, and two great-grand children. Before my father died, at the age of seventy-one, there were five brothers and sisters; in my mother's the same (she is now ninety-five), and in my wife's father's and mother's families nine each, making twenty-eight persons in the four families from which we sprang, from sixty to eighty-five years, and none of them were given to drink. My wife's father died at eighty-eight, having lived a married life of nearly sixty-five years. His widow is now past ninety.

The late Hon. B. F. Tefft, when Minister to Holland, held a public discussion with Lord John Russell, in London, on the comparative advantages of America and England. He told me he beat his antagonist on nearly every point, and when they came to the comparative longevity, he gave him such a discomfiture as to bring down the house; the facts with which he did it being gathered in a temperance village among the hills of Maine.

Dr. E. Michner, of Pennsylvania, at the age of fifteen, resolved on a life of entire abstinence. When past ninety he was in his customary vigor and mental activity.

Seth Davis, of Newton, who saw upwards of one hundred years, was a worker for temperance over

sixty. George L. Perkins, of Connecticut, does not use drink, and is past one hundred years. In my father's neighborhood Mr. Whitney saw one hundred and seven, Mrs. Kidder one hundred and five, and Mrs. Winslow one hundred and four years. The latter, in her one hundred and second year, sang to me "The Happy Man." None of these ever tasted beer, and for the most were contented Christian people.

Chevreuil, of France, is over one hundred, and never tasted spirits, and does not smoke. Before the French Academy, Lanceraux, in a paper, in 1885, showed that fifty or sixty is the highest age alcoholists ever attain. And we showed, from good authority in this country, that not three out of one hundred heavy beer drinkers reach fifty-five years. The ministry in France in 1860 addressed letters to all the Fréfets asking for the conditions of longevity. "Sobriety" was the leading answer. In 1880 Legoyt reviewed the centenarians of various countries, and found great temperance the foremost condition of their age. Such instances could be multiplied a hundred fold were it necessary. They show conclusively that beer is no necessary "milk" for the old; on the contrary, they who take it fail to reach great age.

2. *The Free Dosing with Alcohol.*—Since the enthusiastic Dr. Todd did more than any other physician to introduce and popularize the liquor treatment of disease, particularly in fevers and acute inflammations, some of his views may here be stated:

Alcohol was food—the *appropriate pabulum* for the nourishment of the nervous system, as albumen is the pabulum for the muscles. It was superior to all other things as the repairer of nervous waste. There is no true secondary depression of the vital powers following its use, except when by its abundance it deranges digestion.

It should be given in large and frequent doses to save the tissues from undergoing oxidation, being itself the most assimilable material for oxidation.

It is very dangerous to withdraw alcohol except it disagree with digestion. *Coma and delirium from an excess of alcohol rather indicate that more alcohol should be given*—which reminds me of the boy who got sick from eating a half peck of apples and was advised to eat another half peck for his cure.

Following Dr. Todd's teaching, Jane Cook, of seventeen, got six drachms of brandy every hour for rheumatic inflammation, and Sarah Butcher, with a different inflammation, got a pint of brandy every day for a month. On this line, Dr. Anstie mentions a feeble lady who was advised by her physician to drink wine to the verge of intoxication, and a man who got fourteen ounces of brandy a day till affected with alcoholism and went under the doctor's care for that.

During an outbreak of cholera in Boston upwards of twenty years ago a woman was dosed to drunkenness with liquor, and so added the spewings of that state to the vomitings and purgings of the cholera—a horrid state in which to exchange worlds. What was the matter that her physician could not have found something more rationally adapted to her case? Only A. D. 1887, a Boston doctor prescribed tablespoonful doses of brandy to a child two years old, the drug to be taken every two hours. The mother refused the orders, and her child is alive. O, the ignorance alcohol covers! The fashionable "malaria" cannot hide one tithe the stupidity.

How strange all this looks in the light of its physiology as we have so fully detailed it! No wonder the French physicians pronounced Dr. Todd a "madman."

(1) *This Treatment Denounced by Eminent Prac-*

titioners.—Said Dr. J. B. Williams at the London Royal College of Physicians: "I am opposed to the practice of keeping patients with pneumonia and bronchitis in a state of constant semi-intoxication with brandy. No doubt patients do sometimes recover under this treatment, but their recovery is more tardy than that from a more moderate and rational plan; and convalescence and subsequent health are often impaired by the craving for and indulgence in stimulants which this practice produces. I have known of several and have heard of more cases of dipsomania which dated their origin from this spirituous medication."

On this point Dr. Forbes Winslow says: "that he has known many persons who cursed the day when Dr. Todd entered their house, because he had recommended alcoholic drinks as remedies, and thus had sanctioned a course of tippling to which they became slaves."

Dr. Gulia, a learned Maltese physician, expresses himself thus: "It is an outrageous Brownian school endeavoring, with little good sense, to establish a treatment not less fatal than that of the Tommasiniani' (the bleeders). They make their patients gulp down wine and brandy and every sort of diffusible stimulant in a routine fashion, and without any moderation, and, loathing every other medicine, try to convert the chemists' into liquor shops. They are, for the most part, followers of Todd, who holds that where strong doses of alcohol are not used it is impossible to overcome a serious attack of fever, and insists that its use is in no way to be given up, even if the febrile symptoms are aggravated, and delirium or coma, twitching of the tendons, with other adynamic and ataxic symptoms come on; because it is better to err by excess of stimulants than to give too little;

and elsewhere he asserts that it is much more dangerous to diminish or discontinue alcohol than to give large doses. With Dr. Todd's school, alcohol is the single nourishment to which recourse should be had to replace the material wasted in fever and the greater number of acute maladies, and to withstand functional exhaustion."

Dr. Gairdner, of Edinburgh: "I cannot but demur to his inference that delirium and other bad symptoms, even if increased under small doses, are to be kept down by giving much larger quantities. To regard flushing of the face and increased feverishness, for example, as not a contra-indication, but a reason for increased administration, is opposed entirely to the practice I have followed; and, accordingly, it has not occurred to me to have to 'sluice the head well with cold water,' or to use any of the other means recommended in Dr. Todd's fourteenth lecture, in order to distinguish 'the coma of alcohol' from 'the coma of disease' in cases of *accidental overstimulation*." In reference to other diseases, he says: "I believe that much more mischief is done by the routine administration of stimulants than could possibly result even from their entire suppression in hospital practice."

Dr. H. C. Wood, Jr., regards it not only powerless for good in the early stages of peritonitis; but a few doses of brandy may produce death, since it only adds fuel to the fire. Hertz says it is only in the lighter forms of fever that liquors can do any good; and that is just where they are not needed.

Dr. Peddie suppresses the habitual allowance of liquor in delirium tremens, asserting that this course is not dangerous, but, on the other hand, extremely favorable to a cure.

But this is not all the condemnation. Like the weaver who "got hung in his yarn," Dr. Todd was

himself sacrificed by his medicine. Dr. Lees charges the death of the Prince Consort of England to the same treatment. And we shall see further on that just in proportion as alcohol has been relied on for internal use, death has cried out against it.

Dr. Chambers' views—at least, his early views—come under Dr. Todd's school. He, however, has some peculiar notions of his own.

He advises a "rule directly opposite to that which governs the giving nutritous food" "The quantity considered necessary in proportion to the previous habits of the patient, should be given in *one*, or at most *two* doses during the twenty-four hours. *The frequent repetition of small doses has appeared to me more injurious, or, at all events, less beneficial than the same quantity in a few larger doses*," which is contrary to the general belief of the profession. "In pneumonia in old persons, especially in the *upper classes, who have been used to good living*, and persons of all ages, who have indulged freely in alcoholic liquids, may begin wine immediately; there is no need to wait till advanced nervous symptoms come on."

Now, all this is directly opposed to the best thought of to-day. In a letter to me, the late Dr. E. R. Peaslee, the nestor of medical wisdom of New York, stated that in such cases "alcohol ceases to be a medicine, and no good can be hoped for from its use." Precisely according with Prof. Peaslee are the statements of Dr William Stokes, Professor of Physic in the University of Dublin. In his Lectures on Fever, he shows that the best results are in the strictly temperate. Men of anxious callings, or worn out by literary labors, who might be supposed to need the liquor treatment, bear it badly. This, then, is the thread which runs through all: *Persons who are strong and resisting endure the so-called stimulants, while they*

who, by any means, are weak cannot bear them. A strange strengthener this, which only the strong can bear! So Dr. Stokes found the best results of the liquor treatment in fever cases to be among the non-using country Irishmen, and not among the toddy-using Dubliners. In other words, *liquors did the strong less harm than they did the weak.*

We have already seen, according to Dr. Chambers' statements, liquors are more harmful in the morning than in the afternoon, and that he rejected from life insurance all applicants who took forenoon nips. Did he or any one else suppose beefsteak or any other really sustaining article is poisonous one part of the day and wholesome the other?

The fact comes out, alcohol is alcohol, and neither the time of day nor the strength of the person changes its nature; only its effects can be resisted under some circumstances better than under others. According to Dr. Chambers, its *best action is that it does the least harm.* Wonderful medicine this for one's confidence!

(2) *This Treatment Bad in Results.*—Dr. Murchison wrote on the fevers of Great Britain, condemning the excessive use of alcohol by Dr. Todd, yet moderately used it himself. The comparison he draws is therefore between the greater and the less use, and not between the alcoholic and the non-alcoholic.

TYPHOID FEVER.

	Free Liquor Treatment by Dr. Todd, at the King's College Hospital.			Moderate Liquor Treatment by Dr. Murchison, at the London Fever Hospital.		
Years.	Cases.	Deaths.	Per Cent.	Cases.	Deaths.	Per Cent.
Under 20	63	11	17.46	876	131	14.95
Over 20	67	16	23.88	896	199	22.21
" 30	18	9	50	252	71	28.17
" 40	7	5	71.42	92	27	28.14
" 50	5	4	80	26	14	52.84

TYPHUS FEVER.

Under 20	34	6	17.64	1109	61	5.05
Over 20	74	22	29.73	2347	643	27.39
" 30	41	15	36.54	1509	544	36.05
" 40	25	10	40	911	400	43.66

Things being equal, the balance of success was with Dr. Murchison. Unlike Dr. Todd, he denied all nutritious qualities to alcohol, and gave it only as a stimulant.

Both treatments were conducted at the same time in the Cork Fever Hospital, in 1873–5, and with similar results to the above. Dr. MacNaughton Jones made the observations, and concluded: 1. In the treatment of typhus and other fevers, "too much reliance has been placed on alcoholic stimulants—fashion, not reason, swaying in their indiscriminate employment. 2. The per cent. of cases requiring such stimulants is a low one; and while our administration of them, as regards kind and quantity, must depend entirely upon the condition of the patient; still the utmost caution is required"—views expressed before our latest physiology.

In the chills of malarial fever, Hertz asserts that "alcoholic drinks can do only harm," a fact Dr. G. B. Wood long since taught.

Dr. Desguin, before the International Medical Congress, at Brussels, in 1875, maintained that "alcohol is contraindicated in simple febrile diseases, since it causes a decrease of the pulse and temperature, and if it also diminishes the excretion of urea, these results are due to *embarrassment of functions;* they mark the organic lesions; they may prevent the natural evolutions and hinder the resolution of the exudations. In a word, they put the organism into an unnatural state, which renders the cure of inflammatory affections longer and more difficult."

These statements were supported by M. M. Crocq and Mahaux, who found other agents better and safer in combatting high temperatures and inflammatory actions, and also by Dr. Achmet Bey, of Constantinople.

So Dr. E. P. Hurd, of Nubryport: "Valuable as alcohol might seem as an antipyretic agent, this refrigeratory action is bought at the expense of an interruption of hæmatosis (blood-making), a spoiling of the corpuscular elements of the blood, which renders the medication baneful rather than salutary."

Thirty years' close observation and practice led Dr. James L. Perryman, of Illinois, to believe that alcohol does not prevent tissue change and waste. "I am certain," says he, "that they are not necessary to sustain the vital forces, but, on the contrary, hurtful and positively injurious."

Dr. J. B. Carrell, of Pennsylvania, advises, when we do use the drug to bear in mind what Dr. Ashcom said of it when he declared that "it is the devil's best hold to damn the human race, and it is humiliating to know that so many are his willing and thoughtless aiders and abettors."

3. *The Non-alcoholic, or Very Limited Treatment.* —Dr. Carpenter, the great physiologist, showed that alcohol was *de*structive and not *con*structive of nervous matter, exciting the system as the lash the horse, and, so, wasting force and vitality. The *pabulum of nerve-matter*, with him, was albumen, phosphorized fats, and the like, not alcohol. Rest, sleep, air, normal food, feed the nerves; alcohol compels the nerves to feed on themselves, committing gradual suicide. In persons said to have been sustained a long time on liquor only, the water with it dissolved out the nutrition in the tissues, so they would have lived

longer supplied with water alone. Cases requiring excitation do better on tea, coffee, cocoa. They promote excretion of the urea, etc., which alcohol checks, urea playing the alarming rôle in grave fevers, together with the imperfect oxidation of the blood alcohol increases. Yet there is nothing so taking with sick people as a *show of wisdom;* and physicians who flourish the wine and brandy have the advantage over ignorance, though the liquor be an enemy.

(1) *This Treatment Approved by the Ablest Physicians.*—On inquiry, Dr. Harlow, of the Maine Insane Hospital, wrote: "We do not use alcohol in any of its forms in the treatment of insanity, as a rule. We use it as we would any other therapeutical agent that is poisonous, with great caution." The American Medical Association relegates it to the class of strong poisonous drugs, to be used only under the strict limits of science, art, and medicine. Being curious to know what the learned professor, Dr. Robley Dunglison, thought of it, I turned to his "Materia Medica," printed in 1850, and ran down the forty-four octavo columns of Diseases and Their Remedies, containing 789 diseases and their modifications, with suggestions for treatment 2566 times, in which alcohol, in some form, was suggested 21 times only—10 externally and 11 internally. The external use was for bruises, burns, hemorrhage, erysipelas, inflammation, scalds, sprains, inflamed eyes—brandy for weakness, and alcohol injection into hydrocele. Internally, alcohol is suggested 6 times, including its use in delirium tremens; porter and ale twice, and wines three times; and were he alive and writing to-day, it is safe to say he would have omitted fully one-half of these.

My former instructor, the late Prof. Peaslee, wrote: "I use brandy and the other forms of alcohol for

internal administration, *but only in exceptional cases.* But to get any *certain beneficial effects in desperate cases, the patient must not have been accustomed previously to its habitual use. If used habitually in health it ceases to be a remedy in disease.* It should always be prescribed under *protest* and for the *time* only; though some of the weaker forms may be required for days or weeks, in succession in desperate chronic cases." Even he in this appears to be under old notions, or he would not have regarded it as strengthening.

In rheumatism, especially where there is heredity, Prof. Roberts Bartholow teaches that "large draughts of milk are useful by maintaining free action of the kidneys; coffee and tea are allowable; but wine, beer, and spirits, are injurious."

Dr. B. W. Richardson (*London Lancet*, 1876), says: "There are cases, commonly called cases of debility, in which there is no objective sign of organic disease. The leading symptoms are those of persistent dyspepsia, flatulency, irregular action of the bowels; hemorrhoids, much exhaustion under moderate physical exertion, and great mental depression under slight mental disturbances, extreme nervous excitability, amounting to hysterical excitement, a condition of urine variable in character—the fluid sometimes of straw color and abundant, at other times, scanty and loaded with lithates, the sleep is disturbed with frequent movements and muscular starts of the lower limbs at the moment of going to sleep, a deficient appetite, and a white, loaded tongue. In these examples—as common, by the way, to-day as in former times—the old practice used to consist in trying to regulate the wine or other alcoholic beverage. My experience now is that these symptoms are, in nearly every instance, caused by alcohol, and that the only certain successful treatment is total abstinence. To

the practical conclusions here stated I have been led by the study of the action of alcohol upon the healthy body. The phenomena described are the symptoms of alcohol when it is taken in what is presumed to be a moderate and, as it has seemed to many, a necessary quantity. As a medicine, it has no place."

Dr. Norman Kerr (Meeting British Medical Association, 1876), condemned it in both active and passive hemorrhages. More than 50 cases of *postpartum* hemorrhage had been successfully treated by him without it. Of twenty-eight cases of rheumatic fever he lost only 1. Only 3 out of 164 cases of delirium tremens died—the usual average being 1 out of 5; 1 out of 25 cases of pneumonia, on an average, perished. It was wrong to give brandy in the milk in bronchitis; for ammonia is better and freer from harm. Fevers, erysipelas, diphtheria, carbuncle, pyæmia, and cholera, are all more successfully treated without than with it. For shock, collapse, hot applications and aromatics are preferable, and to be used after surgical operations. Rest, easily-digested food, help chronic diseases, while alcohol opposes them.

Dr. J. James Ridge formerly thought it impossible to treat diseases without liquor, but at length entirely discarded it.

Sir Henry Thompson regards it as a "luxury," and not in any sense a medicine.

"Are there any facts," inquires Dr. Ridge, "apart from all fancies, impressions, or feelings in its favor?" Science in its demonstrations is against it. How, then, can there be facts in its favor? Does a king's touch cure a king's evil? Sam Johnson was a scrofulous boy, and at the age of thirty months, by the direction of the family physician, received the royal touch of Queen Anne. Does science confirm, or reject, the notion? If such a touch can do no good,

it will at least do no harm. Can such be said of alcohol? But in this year, 1888, a medical writer, referring to the treatment of typhoid fever in twelve of the principal American hospitals, dares to announce, in the face of the accumulating demonstrations of science, that "the use of alcohol is recommended by all the writers, and we have, as yet, no substitute for it in the progressive asthenia of the disease." I fear there is no hope for such a doctor. Where has he lived? I leave him with the late president of the International Medical Congress, held this same year at Washington, Dr. N. S. Davis, who says:

"We have tried the experiment of treating typhoid fever and all other general fevers without using alcoholic remedies, both in hospital and private practice, for thirty years, and have found no difficulty in finding better remedies for counteracting the asthenia of this fever, and obtaining a higher ratio of recoveries than has ever been obtained with its use. With iodine as a general alterant and antiseptic to counteract the molecular degeneration in the tissues and the blood, and the choice of cardiac and vasomotor tonics from the class of remedies represented by digitalis, coffee, tea, strychnine, strophanthus, carbonate of ammonia, camphor, etc., according to the special symptoms of each case, and vigilant attention to the local complications that are in many cases more dangerous to the patient than the general disease, with an equally vigilant attention to the proper administration of simple nourishment and pure air, we have no place or need for the use of alcohol as a remedy in these cases." As he has found, so have many other intelligent, active, and successful practitioners found.

That alcohol is not a help, but a hinderance to asthenic cases, let Dr. Charles McLean tell his per-

sonal experience: "I was much struck last spring with the effect of wine on myself as a patient. I had just emerged from enteric [typhoid] fever, and there being all the indications for its use, I was ordered and took wine. Now, instead of benefiting me, it seemed to do just the reverse. I took two glasses during the twenty-four hours. It stimulated in a remarkable manner the heart's action, and always produced, more or less, a feeling of cold; which latter is interesting as showing that wine influences the contractility of the minute as well as the large vessels, although it is probably indirectly through the nervous system. But that such stimulation was unnecessary, and indeed injurious, appears from the fact that when I went out and walked a few miles after taking a glass of wine, a cold perspiration would break out generally, and a feeling of exhaustion come on, compelling me often to sit down at the roadside during my walk; whereas, going to see the same patient another day before taking the stimulant, I felt quite another being. All the time I was taking wine, for two months after I got out of bed, my pulse could not be coaxed below 120. But at the end of this period, I stopped the wine; and from that time I date my satisfactory convalescence. I soon noticed a lowering of the pulse; and, certainly, before a fortnight passed, it was down to 72, and faintness and other disagreeable symptoms belonged to the past."

Dr. McLean believed the wine materially retarded his recovery by preventing the filling up of the tissues by nutritive processes on which return to strength depended. Seeing the great irrelevancy between wine and such weakness, he predicted that the time was near when it would cease to be administered for such purposes and confined to such emergencies as require a heart excitant only.

But as overwhelming testimony only will undeceive the votaries at this shrine, I make one more proposition:

(2) *The Non-alcoholic Treatment Gives the Higher Success.*—It must be that the best results are obtained where alcohol is discarded in treatment, and that for two reasons: 1. When habitually used, it degrades the constitutional powers, as seen from the fact that when drinkers come down with any acute fever they are much more likely to die. Thus, nearly all drinkers die of small-pox, yellow fever, cholera, typhus fever, etc. The death-rate of drinkers in typhoid fever Liebermeister gives as seven in nineteen, or more than three times the usual proportion. 2. In all fevers there is rapid disintegration of tissue, with obstruction to the elimination of the products, which obstruction is further increased by the spirit; it thus adds both fuel to the fire and fans the flames; whereas correct therapeutics in fever should encourage elimination.

Prof. Alonzo Clark, of New York, once put an equal number of typhoid cases into two different wards and treated the one group in the ordinary way with opium, liquor, etc.; but the other had plenty of air, diluents, etc., but no opium or liquor. The latter having no obstruction to elimination placed in the way, but having the elimination favored by the fresh air and diluents did much better than the first group. The hospital being full, he was obliged to put a third group out under an awning open on all sides. They received no liquor and the conditions for elimination being the best, they did the best of all.

A case of delirium tremens lately came under my care where the obstructed condition of the body was being kept up by liquor dosing. I at once removed the obstructor, favored the cleansing processes, the

stomach rejecting, I gave food by enema, and soon saw the benefit of the course. Dr. A. Day, of this city, withdraws all liquors from his cases of delirium tremens at the first. If alcohol were a support, it ought to be harmful to withdraw it. Yet Mr. Smith, of the Edinburgh Jail, saw 150,000 criminals pass in and out, many of whom were hard drinkers. At once their liquor was cut off, and not one was injured thereby, which also justifies Dr. J. C. Thorowgood's statement: "I never yet knew any one permanently injured by a trial of total abstinence."

Dr. Higginbottom, of Nottingham, has not used the so-called stimulants for thirty years, and finds the results of his practice perfectly satisfactory. Alcohol is neither food nor physic.

Dr. Collenette, of the Isle of Guernsey, writes: "For twenty-one years I have banished all intoxicants from my practice, and during that period I have made not fewer than 180,000 medical visits, and I hesitate not to say that the recoveries have been more numerous and more rapid then they were during the five years I followed the usual practice, and administered brandy, wine, and beer."

Dr. Robert Perry, of Glasgow, reviewing the epidemic of typhus fever of 1855–6, states: "I have never been in the habit of administering alcoholic stimulants in typhus in the nature of a routine, nor have I been at all guided in my use of them by the age of the patient; but, in every instance, I judge each individual case according to its own requirements, administering or withholding wine or spirits, as the particular case requires the stimulant or does not. Practically, however, the conclusions, at which I have arrived from a retrospective review of my cases, are almost identical with those so forcibly and clearly enumerated by Dr. Gairdner. I have ascer-

tained that 534 cases were treated with wine or spirits during some part of their illness, and out of their number 138 died. On the other hand, 491 were treated without any alcoholic stimulants, with only 9 deaths."

Just how far this great disparity was due to the liquor we cannot say, yet all our reasoning and experience places a large measure of it there. His guide was the state of the pulse pointed out by Dr. Stokes, which, to our view, was fallacious, in which view we are strengthened by the opinion of Dr. Keith Anderson, of the same infirmary with Dr. Perry. He noticed that in *all cases of typhus the daily excretion of urea was decidedly below the normal standard of health*, particularly during the second week; that the head or nervous symptoms were always in close accord with the amount of the urea discharged or retained; and that improvement always followed an increased elimination of this product. Elsewhere we have seen that alcohol decreases the elimination of urea, and hence we conclude that any supposed benefit of alcohol to the pulse is more than offset by its hindering action on the kidneys. For years I have kept this point in mind when treating fevers, and, by milk and other eliminants, have kept the kidneys at work, and nervous pains and delirium rarely occur. To me it is plain that the more urinous the breath and skin, the more dangerous is it to give alcohol, it being physiologically contraindicated. And there occurs to me at this writing where I saw a case of this kind in consultation, and advised relieving the kidneys, but the physician in charge was set on "bridging the chasm," administered brandy and lost his patient. The presence of delirium points in the same direction.

These statements find full support in the *treatment of typhoid fever*—the common fever of Europe and

this country, particularly of New England, and like scarlet fever, measles, etc., usually attacks persons before middle life, and but once.

Out of 230 cases of this fever, under Dr. Chambers in the St. Mary's Hospital, 109 were treated in the usual way or on "general principles," twenty-one or one in five died. The remaining 121 were treated after the Doctor's later physiological way, by abundance of milk and beef-tea, with means favoring free removal of waste matters, and three died, or one out of forty only. A similar practice lowered the death-rate of continued fever in Shanghai from 28 to 7 per cent., or just three-fourths. Dr. Bishop found the same good result of the non-alcoholic treatment of the fevers of Naples. During an epidemic of typhus (probably typhoid) in Boston in 1847–8, Dr. B. E. Cotting took care of 307 cases without alcohol, and only one out of ten died.

For more than thirty years the writer has made free use of milk in this and all other fevers, with results highly satisfactory, both as to the grade of the disease and the final outcome, compared with the liquor treatment about him. Under his treatment typhoid fever has lost much of its terror, and though not arrested, it is modified and mitigated from the first, runs a shorter course, and delirium is rare. The reports of this disease at the Boston City Hospital, where liquor is used, give twenty-eight to thirty days before convalescence, or about a week longer than the average of my cases. In 1884, a family of nine children and the mother, she being in the familyway, all went safely through the fever, the youngest being nine months and the oldest child fourteen years. This should be enough and to spare, but as the alcoholic treatment of fevers is the key to its use in medicine at all, I will continue the showing.

Dr. Hudson ("Lectures on the Study of Fever,

1869") says: "With regard to wine, no precise rule can be laid down. Some cases do not require any. Some are even positively injured by it." It has its best effects when given in the after portion of the day and during the night. When the crisis is passed it should be given up, at which time "its rapid withdrawal is suggested by theory and justified by experience."

But there is a physiological fact, which is generally overlooked, which bears just here. It is that the *vital force of the body moves in a wave-like rythm, and not evenly along*. From the trough of this wave in the early morning, there is a gradual rise till noon, when this force is greatest, then comes a gradual decline towards evening, but not very great. In the forepart of the night it rises again, but not so high as at noon, then it goes down and strikes the lowest trough in the latter part of the night or early morning. By this it is seen that there is a double wave, the highest crest of which is about noon, and the lowest trough from 4 to 8 o'clock in the morning. Hence, persons who are sinking from wasting diseases and die of prostration almost always die at the time when the force of the vital wave is the least—that is, in the early morning and not in the middle of the day. This is the case with fevers, consumption, etc.

Now, comparing this with the observations of Dr. Hudson just mentioned, it will be seen that he found alcohol to work the best when given at the times when the vital force was the greatest, and not when it was the least. If it be a stimulant and a strengthener, it ought to do the most good when it is the most needed, yet experience shows that it is not safe to give it then—the best time being when there is the most strength to resist it, and the best patients for it are those who are stout and strong, as we elsewhere

showed—experiences exactly in the line of its physiology. The grounds on which Dr. Hudson recommends its speedy withdrawal make against its employment at the first; for, after the crisis, he says: "We know at this period there is an enormous waste of tissue, with corresponding increase of elimination of its products."

Now, the tissues have been wasting all the time, and because of the deficient elimination their products have accumulated in the system, and hence this elimination should have been encouraged from the very outset, and modified the case at the start. The foul breath is a clear proof of the necessity of increased elimination.

But says Dr. Hudson after the crisis (which according to our treatment we see very little of, the disease vanishing away from near the first): "*By continuing our alcoholic stimulants we retard the process, thus acting contrary to the indications of nature.*" And is not this just what alcohol does all the time? "In practice," says he, "we find the abuse of alcohol followed by heat and dryness of skin, rapid, irritable action of the heart, thirst and restlessness, want of sleep, and return of delirium, subsultus, etc., etc."

Further, "I have mentioned, in a former lecture, that the crisis is not unfrequently followed, after a short interval, by an access of watchfulness and delirium, especially in the young patient, or in one whose brain has been overworked previously to the fever. In this state you must be careful not to administer wine or stimulants." "These cases will be aided by a withdrawal of all stimuli"—in other words, they will do better if it is not resorted to at all.

(3) *The Use of Alcohol Must be with Great Discrimination.*—Dr. Bateman treated a case of fever in a very low state of collapse by employing warmth and

nutritious food, to which he added wine or spirits. Reaction took place, as he supposed, from the alcoholics employed, and not daring to leave the liquor off, phrenitis came on, and his patient died. Now, the liquor may or may not have aided in the reaction, but it caused the patient's death by inducing brain fever, just in accordance with its physiological action. Prof. Bing, of Bonn University, asserts that "alcohol induces dilatation of the capillaries of various regions of the body, but especially of those of the head, with great precision and certainty"—just what it did in Dr. Bateman's case.

A prominent doctor of this city gave hot wine to some scarlet fever cases, and set their brains into frenzy, then wondered at the untoward results. Said Dr. Bateman: "It is manifest that stimulants should be regulated with great caution, even when most essentially required, and according to their present effects." Dr. Hudson, like every other advocate of the alcohol treatment, leaves us wholly in the dark as to any definite principles to guide us in its use. As Dr. Chambers said of bloodletting, so we say of alcohol: "It is time that the wave of opinion, which has swelled backward and forward to a dangerous height, should settle down into a steady stream. We ought to know clearly *why* we use it, and then we shall know *when* to use it."

But it is wonderful how the *facts of experience* are coming to a focus, giving less and less curative value to this agent. Once its administration was opposed from radical inclination; now by force of accumulated facts.

"The most important question in therapeutics at the present time," said Dr. Wilks, in a clinical lecture at Guy's Hospital, "is the value of alcohol in disease. If it be said that its frequent use is an evi-

dence of its potency; this is the more sufficient reason why its administration should be watched with the extremest care. Like other drugs, it may be beneficial, useless, or harmful. Fevers will do well without it.

"So wedded, however, are some to the idea of the absolute necessity of stimulants, that they have expressed almost incredulity when they have heard it stated that fevers will terminate favorably without them. . . . Young persons with typhus and typhoid do better, I believe, without them. That they make good recoveries on simple milk diet is a fact which my hospital cases prove, and which no arguments can gainsay; and, on the other hand, I have seen a marked improvement take place in some cases where a stimulus has been left off. It is also a fact that in bronchitis I have repeatedly seen improvement after stimulants have been omitted; and, as regards heart disease, I am convinced that the amount of mischief done by stimulants is immense." Contrary to Dr. Stokes' rule, he says: "*In the case of fevers and bronchitis, the weak pulse is often but an indication of extreme capillary congestion, and a stimulus to the heart only aggravates the evil;* and in the case of a diseased and weak heart, where repose is indicated, a constant stimulation by alcohol adds immensely to its trouble.

"It causes me daily surprise to observe how the effects of stimulation are overlooked. Often have I been called to see a patient apparently dying, sometimes of a nervous disorder, at another time of a liver complaint, and at another of heart disease. He is lying in bed, where he (or she) has been for some time, kept alive (as it is said) by brandy; the breath is abominably fetid; the heart's action is so rapid that it is impossible to say whether the organ is dis-

eased or not; the patient refuses food; or if this be taken, it is rejected, and so he is plied with brandy to keep him alive; the body is, in fact, saturated with spirit.

"My first remark on seeing such a case is that man cannot live on alcohol; he must take food, or he will die." But the friends or ignorant physicians are afraid that if the liquor is not still poured down, the patient will sink. "It is assumed," says Dr. W., "that the constant administration of brandy is necessary for the temporary maintenance of life, and the idea never seems to have been conceived that the stimulation of the heart causes the weak, fluttering pulse; and the stimulation of the stomach, a subacute gastritis."

The course which Dr. W. advises, is to withdraw every drop of the stimulant, and in a few hours the irritated stomach has time to rest and become retentive; nourishment borne, and the patient improves. He has not the least fears in the removal of the stimulant at once. Delirium, which is popularly feared in such a case, does not come on. "It is not induced by the withdrawal of stimulants. There are no facts to show that the withdrawal of the accustomed drink is attended with any evil results." How contrary is this to old-time teaching, leading to the liquor treatment, with protracted cure, if not fatal results? Rest and repose, with the avoidance of stimulation, is the treatment which the patient requires, together with milk, beef-tea, etc.

Dr. Wilks further says: "That many cases of disease, of various kinds, would do far better without stimulants, I am perfectly confident. But, lately, I have seen the case of a gentleman, about sixty years of age, who passed through a most severe attack of pneumonia without the use of stimulants. He had

been a tolerably free-liver, and would not have been called a good subject; but, having before me the case of another gentleman of the same age, who had just died of pneumonia, and who had taken a large lot of brandy, I readily acquiesced in the patient's own view, that none should be given him. It is remarkable what extremes we have reached, and on how slight a scientific basis is founded the treatment of pneumonia. Not many years ago the antiphlogistic method was adopted, including bleeding, antimony, calomel, etc.; then came the 'let alone' method; and now we have the brandy treatment. My own opinion is, that in any given number of cases a larger majority would recover under the old antiphlogistic treatment than by the more modern method of brandy.

"As regards *heart disease*, the utmost discrimination is required in the use of stimulants. There are cases where an undoubted benefit is produced by them; but there are others, and these I have seen repeatedly, where alcohol has induced palpitation, fluttering, great distress, and constant sleepless nights, but where, on the other hand, the withdrawal of the spirit, and the substitution of a dose of digitalis or henbane, has been of the most essential service. *The administration of a stimulus, in the attempt to overcome disease, in lieu of good, well-tried remedies, evinces the very worst form of medical skepticism* with which I am acquainted."

I beg a careful consideration of the following by this able authority: "It is not only in these severe cases of disease, but in lesser troubles, that your recommendation of stimulants may do incalculable mischief. You visit, for example, an ailing lady, and she details to you a number of troubles of a nervous and dyspeptic character. She is sitting indoors all day, taking no exercise, living well, and conse-

quently drifting into a weak and flabby condition. You place your hand on her pulse, and, finding it feeble, condole with her on her state of health, assure her that she does not live well enough, and order her a few extra glasses of wine or a *little* brandy. You find that she grows no better for the advice; but perhaps you never reflect that you have been adding fuel to the fire. Knowing not what to do in the way of treatment, you order her out of town, and she immediately begins to improve. She goes to Brighton, rides on horseback, or walks miles a day on the Parade, regains her appetite, craves less for stimulants, and her health is restored. If, on the contrary, you fail to remove her from her home, she goes from bad to worse; she takes to her bed, eats less food, drinks more wine and brandy, until, having become one mass of fatty degeneration, life can hold no longer, and death ends the scene. The lady has been killed by kindness. This is no imaginary case; my mind's eye is carrying me to more than one such instance.

"Do not, then, assume that alcohol is equivalent to a tonic, and that it must be necessarily administered because your patient is weak. It may be that that very weakness is due to the long-continued pernicious effects of this same stimulant; indeed, as you have often heard me say, if a man comes into our presence with a tottering gait, bloated face, and his nervous energy all gone, you may be quite sure he has been taking strengthening things all his life."

(4) *The Term Stimulant Misleading—Alcohol not a Tonic.*—"Tonics," according to Dr. Archibald Billings, "give strength; stimulants call it forth. Stimulants excite action, but action is not strength; overaction induces exhaustion." Wasps up the legs are stimulating in the sense that alcohol is stimulating,

but neither nourishing nor strengthening. Bees in a fever-bed arouse the patient, but to his injury. Both insect poison and alcohol, though exciting, are depressing from the first.

The term stimulant, however, as applied to alcohol, conveys to the mind the idea of some support, and hence is misleading. *Irritant, excitant* is the proper term, just as a drop of honey excites the larynx when it "goes down the wrong way," or as the goad excites the ox. It is in this light we can understand Dr. Chambers when he says of alcohol: "It remains for some time in the body and exerts a powerful influence—a stimulant to the nervous system. But it is clear that we must cease to regard it as in any sense an aliment, *in as much as it goes out as it went in, and does not, so far as we know, leave any of its substance behind it*"—a remarkable statement, coming, as it does, from one who was formerly a follower of Dr. Todd. It shows that he saw the great disparity between the liquor and non-liquor treatment of disease; for we have already stated that when he plied his fever cases with liquor he lost one out of five, and only one out of forty after he adopted more rational means, such as air, aliments, and plenty of true restoratives in the shape of food. Hence we see the force of his instruction to his students when he said: "*Above all I would caution you against employing wine as a substitute for the true restorative treatment.*"

These statements place him exactly with the learned Frenchmen—Lallemand, Perrin, and Duroy, for they assert: "*We never found, in either the blood or tissues, any of the derivatives of alcohol;*" and who, at the end of their investigations, conclude as follows: "These facts establish, from a physiological point of view, a line of demarkation between alcohol and foods. Food restores the forces, without the organism betraying,

by disturbed functions, or by outward agitation, the labor of reparation, which is accomplished silently in the woof of the tissues. Alcohol, on the other hand, immediately provokes, even in a moderate dose, an excitement which extends through the entire economy." That alcohol can go no further than excite, and can in no way support or do the work of a tonic to the vital powers, is also the opinion of the great chemist, Lehmann, who declared that he "does not believe it is capable of contributing anything towards maintaing life."

Corroborative of this were the observations in the late Ashanti campaign under the direction of Prof. Parkes. They were: "The first effects of alcohol, when given in a moderate dose (what is equal to one fluid ounce of absolute alcohol), is reviving, but this effect is transient. The reviving effect goes off after at the utmost two and a half miles of additional march, and sometimes much before this; then the previous languor and sense of exhaustion not only return, but are sometimes more intense, and if alcohol is again resorted to, its effects are now less satisfactory. Its reviving power is usually not so marked, and its peculiar anæsthetic and narcotising influence can often be distinctly traced. The men feel heavy, dull, disinclined to march, and are less willing and cheerful."

"From this," says Dr. T. L. Brunton, "it is evident that alcohol does not impart strength, but rather enables a man to use up in a short time the energy usually requiring much longer time to expend. If he only requires to make a single effort and can rest afterward until he has replaced his exhausted store, the additional temporary strength obtained by using alcohol may enable him to overcome an obstacle which would otherwise have baffled him, but if he has to make prolonged exertions alcohol is injurious."

To any one even, of little medical knowledge, it must appear that these principles, so thoroughly brought out, stand entirely in the way of the common use of alcohol in fevers and other protracted and prostrating diseases. Hence, I leave the question, honestly put to me the other day by a reformed man, for those who still have faith in alcohol to answer. Said he: "If a small quantity of wine, whisky, or other liquors taken before breakfast will take the strength out of a person's legs, as they did out of mine when I used to drink, how can such liquors strengthen a weak, hungry, exhausted patient? Must they not inevitably do him harm rather than good?"

But these thoughts do not begin and end with the common people. Medical men are recognizing the fact that alcohol cannot be depended on in emergencies such as it has been used for from time immemorial. It has been seen through the mist of ignorance as a friend, but as the sun of science scatters this gloom it reveals more and more the character of an enemy instead. Hence it is with due consideration that the *surgeons of the Bee Line Railroad of Indiana have united in issuing, from business principles, a resolution to the effect "that the practice of administering alcoholic stimulants to persons suffering from railway injuries, attended with 'shock,' by employés or other persons, is highly detrimental to the injured, and should be prohibited.*"

This action of these surgeons is highly approved by the management of the road, and will hereafter be observed. Formerly it would have been thought criminal not to have plied such cases with brandy; now such things cannot rationally be done. And it will ere long be a crime to administer alcoholics to the prostrated, either from disease or accident.

4. *In What Cases is Alcohol Physiologically Appropriate?*—After all here said concerning the physiology of alcohol and of its effects as an internal remedy in general, as shown by so many eminent medical witnesses, the question as to its fitness for internal use at all seems almost like irony.

It is certainly shut up to two classes of cases—the one where an *anæsthetic* is required, and the other where a *heart-excitant* is temporarily needed, in both of which there would be much demand for it *were it either a pure anæsthetic or a simple excitant;* but it is neither, and this is the rub. It is as a double-edged tool which cuts opposite ways at the same time, so that the good we might hope for from its use as an anæsthetic or as an excitant is offset, and usually more than offset, by its back-cut upon the blood-globules whose due functions we have seen to be absolutely necessary at all times. Emphatically, then, there are no diseases where its use is clear and not attended with unavoidable drawbacks; for there are no known conditions where its special interference with the blood globules and the consequent depressive effects on the system can be of service, but must always be harmful. We are, therefore, unquestionably driven to this one point, to say that *if we would ever resort to alcohol as an anæsthetic or as an excitant, it must always be under such conditions, both of time and urgency, as shall cast its injurious effects quite out of account*—conditions found in fewest instances and most limited circumstances, as every thinking physician must know.

(1) *The Use of Alcohol as an Anæsthetic.*—I refer to it here only as a drug for internal use, not for inhalation, for in the latter office it can never compare with ether, though, emergencies might occasionally justify its use. In any event, it is a much more danger-

ous and difficult anæsthetic than ether or chloroform.

Its peculiar sphere when given internally is for the relief of certain temporary neuralgias, not for chronic, as Dr. Anstie correctly taught. It is also contraindicated if there is much general anæmia present. Rarely, only, is it justified in neuralgic dysmenorrhœa, since these cases are invariably associated with defective nerve-nutrition, and this alcohol cannot help. It is admissible in pains depending on spasm or colic, particularly those arising from bowel and uterine conditions when not inflammatory. In some like conditions it may and will relieve distress, but should not be depended on to cure the fundamental condition. It should not be used to relieve such muscular and tired pains as grow out of overwork. For these, tea, hot water, ginger tea, a cup of coffee, with milk, etc., are better till rest can be had. The pains of nerve-tire can be smothered, but not cured, by spirituous drinks. There are no inflammatory pains for which alcohol is eligible, except when externally applied.

(2) *Alcohol as a Temporary Heart-excitant.*—The instances of faintness or syncope from failure of heart-power are sufficiently common in which there is urgent call for something to arouse action. In such cases, the first thing is not liquor, ammonia, water, etc., but *position*—the position so tersely expressed by a learned professor when he said: "Head on the floor, toes towards the ceiling." No time should be wasted in holding the patient up, not to refer to the danger of doing it; in running for stimulants; in carrying the person out of a congregation, etc. *Lay the patient down—head on a level with the back and feet, and if anything more is needed, raise the feet a little.* This done, the patient is safe. Then stimulants may be added if needed; but they are not likely to be needed. If they are, smelling salts, camphor, water sprinkled

on the face, or a cold drink, are the extent of the usual requirements. If, as in rare cases, faintness continues, amyl nitrite, carbonate of ammonia, hot drinks, aromatic spirits of ammonia, nitroglycerin, or some of the preparations of alcohol have a legitimate relation. After severe injuries, mental impressions, or surgical operations, alcohol may be used, but its over-effects in other directions must be guarded against. It has some, though doubtful, reputation in the depressions following inception of poisons, as after the bite of a rattlesnake, etc. In a limited sphere of this sort there is no doubt that alcohol has a genuine therapeutic value—a value enhanced by the facility with which, in the present state of society, it can be obtained. It must be remembered, however, that while it excites, it always depresses. Much has been assumed by medical men on the figure of a bridge spanning a chasm. But it should be borne in mind that the bridge which alcohol can supply is very short, so that only the merest chasms can be built over by it. Any attempt to span a wide breach is physiologically impossible. It will surely result in patient and bridge going down together.

The dose, with few exceptions, must be small. Drs. Anstie and Parkes limit it to one and one-half ounces in the twenty-four hours. But just how much, when and in what cases, should be determined by the intelligent, conscientious physician. Even then there will be times when what should be used will not be clear, and the physician will be at his wit's end. And if he be a reasonable man he will, under the circumstances, do what he rationally can do and wait in so doing till the indications are clear. To do otherwise and fire a random charge of alcohol, not knowing whether good or bad is to come of it, is to betray a want of good sense and feeling, and be an

act of cruel quackery — never for a moment to be thought of by high-minded practitioners.

(3) *Its Substitutes.*—Being forced into these close quarters by the persistent demands of the logic of facts both of sound experience and physiology, we are squarely confronted by the claims of other substances as substitutes for it. And what quality has it that cannot be replaced, or more than replaced, by other agents?

As an anæsthetic, it holds far inferior rank to chloroform, ether, and the preparations of opium, cocaine, or Indian hemp, camphor, chloral-camphor, hot drinks, aromatics, antipyrin, etc. All have a right to be considered in this connection, among which the poorest student of medicine can find quite as useful and, at the same time, much less harmful agents than alcohol can reasonably claim to be.

As an excitant, ammonia, in its various preparations, holds front rank. Turpentine, digitalis, amyl nitrite, caffein, hot aromatics, the nitrites, and the like, are agents of great power as cardiac stimulants, and have not that peculiar drawback on the blood globules, so characteristic of the action of alcoholic liquors. The recent use of nitroglycerin as a heart-stimulant shows it to be very active and certain, and with some physicians is wholly taking the place of brandy. It promises to be our foremost medicine in this respect, except in organic diseases, and has already done royal service in relieving angina pectoris. A drop or two of a 1 per cent. solution is extremely satisfactory in arousing the heart in protracted fainting. It does not begin its work as soon as amyl nitrite, but is much more prolonged in its effects. In a case of collapse of typoid fever, in which Dr. J. B. Burroughs gave brandy and milk with immediate ejection of the same, nitroglycerin answered admirably and

saved the patient. He thinks, with this at hand, physicians may become thorough advocates of total abstinence in respect to alcohol.

Experience has proved that alcohol is not safe, even where it has been supposed to be useful. According to Dr. Kertz, it "can do only harm" in severe malarial fever. Dr. Geo. B. Wood contends that spirits of ammonia act more promptly than brandy, and that ether acts quicker still, and is sooner through with its action. Carbonate of ammonia and the oil of turpentine, given internally, with rubefacients—such as hot water, mustard, etc., externally, are to be preferred in such cases, and are less likely to affect the head when reaction takes place. Chloroform and ether, by the stomach, hypodermic injection, or inhalation, are extremely useful. So are amyl nitrite and nitroglycerin.

If the nerves become exhausted or the stomach be at fault, Dr. Archibald Billings declares it "useless to supply other than fluid nutriment until some renewal of nervous energy takes place. And this restoration will not be expedited by stimulants."

Thus do science and experience unite against alcohol as a remedy in disease, the undisputed and indisputable demonstrations of the London Temperance Hospital, as also other temperance hospitals, going to show that alcohol is not only *not necessary in the sick-room*, but that, on the whole, *patients recover sooner and better without it.* Furthermore, the great medical bodies—the National, the Continental, and the International Medical Congresses of late years, here and in Europe—put it with the most powerful drugs to be used only in extreme cases, otherwise they prohibit its use and commend substitutes in its stead. There remains, then, but one more step for them to take—to expel it *in toto* from the catagory of

medicines for internal use. This the deceitful, unreliable, unmanageable, compound-nature of the thing demands. The "spirit of the age" demands it. Suffering humanity and the honor of our noble profession, as it loves truth and despises quackery, demand it.

Thus have I, like Theseus on the trial of the fabled Minotaur, the destroyer of the youth of Athens, pursued this real monster into the labyrinth of the human body, holding upon the thread of scientific truth and lighting my steps by the quadruplex lamp of chemistry, physiology, pathology, and experience; and though, unlike the hero, I may not report that I have destroyed the destroyer of my people, I have, at least, left some arrows in his sides, among which the following may be mentioned, which are well barbed, and time will work them further in:

1. Alcohol is the only important ingredient in alcoholic liquors—the only one worthy of any consideration. And though adulterations and sophistications abound, their one supreme poison, with rare exceptions, is the alcohol they contain.

2. Alcohol, by its affinity for water, enters and pervades every organ and tissue of the body just in proportion to the amount of water in them; and, lacking affinity for the substance of the parts, it draws out their water by osmose, and shrinks and condenses them and injures both their integrity and function.

3. Alcohol hinders; it never aids digestion.

4. Alcohol enters directly into the blood and exerts a specific action on the blood globules, altering their physical character and depressing their physiological functions; hence deficient oxidation and the accumulation within of effete matter, fatty bloating, and fatty degeneration.

5. Alcohol disorders and diminishes the working power of every vital organ: it irritates the stomach and decreases the flow of gastric juice; it irritates the kidneys and hinders the elimination of urea; it excites, irritates, congests, and variously deranges the liver; it obstructs aëration in the lungs; it first excites the heart, then depresses it, and the sooner exhausts it on the whole; it congests the brain and afterwards begets cerebral anæmia, shrinkage, and hardening.

6. Alcohol, by its action on the blood globules cools, it never warms the body. The feeling that it does so is deceptive and is misinterpreted.

7. Alcohol weakens both body and mind. It is the teaming fountain of nervous disorders, insanity and idiocy.

8. Alcohol is not food in any sense of the term. It is not even an "accessory food" by any just interpretation.

9. Alcohol does not diminish the waste of tissue in the sense of saving it alive. It does obstruct the elimination from the body of the products of necessary decay. Hence, the theory of the "conservation of tissue" is an unfounded, unwarranted assumption, and contrary to all physiological teaching and just reasoning.

10. Alcohol does not undergo oxidation in the body, there being not a shadow of proof of such a change. The fact that it can be detected in the excretions, the blood and the tissues, ten, twenty, thirty-six (Percy), and even a hundred and twenty hours (Parkes and Wollowicz) after ingestion, is an argument that it does not change. Moreover, it is positive that a considerable portion of it does escape through the various outlets in an unchanged state.

To be sure, a large proportion of it does defy detec-

tion; but this is by no means a proof of its oxidation any more than it is a proof of its escape, unless positive proof of the oxidation can be produced, which has never been done. In the absence of such knowledge, it is rational to conclude that all of it goes out of the system as so much of it is known to go—just as ether, chloroform, paraldehyde, camphor, etc., go —though long in doing so. As a hot, wet sponge gives up its moisture, so does the body part with alcohol, and chiefly by exhalation.

11. Alcohol is an anæsthetic to the nervous system. This fact, coupled with its peculiar effects on the blood globules, renders it a physiological vampire, fanning its victim with its etherial wings, while it preys on the life-blood.

12. As a medicine, alcohol may be employed externally and internally, but not "eternally." For external use it has many very good qualities, but none of them are necessary since satisfactory substitutes abound. Internally its legitimate use is very limited, being confined to anæsthetics and heart-excitants. But, unfortunately for it, all its uses are attended with grave drawbacks, so that it is easy to find other agents less harmful, which will fill, and usually more than fill, its place. Hence, the physicians who use little or none of it, other things being equal, are the most successful with their cases, and are to be preferred by the sick.

13. On the whole, *alcohol is a foreigner to the human body, both in nature and in action—an enemy.* It has usurped the sceptre and come to the throne through seas of blood no earthly tyrant even knew: blood from every pore and bodily tissue from the blows it has dealt from within — blood from feuds it has fomented without—blood from wretchedness, misery, starvation, disease for want of the bread it has cut off

and destroyed. Nevertheless, it has its virtues. So had Nero; so had Alexander; so had Napoleon. But Nero took his own life and rid the world of a tyrant; the great Conqueror was himself conquered and killed by drink; his own nation stripped Napoleon of his royal robes and sent him to a rocky island to die alone.

Alcohol will not destroy itself, nor can its few virtues redeem it in the face of its exceeding hostility to the race and the havoc it has wrought. BANISHMENT IS ITS DUE.

THE END.

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